DOCUMENT RESUME

ED 219 255 SE 038 757

AUTHOR Cunningham, Carl; And Others
TITLE Ideas and Activities for 7-9 Mathematics. Curriculum Support Series.
INSTITUTION Manitoba Dept. of Education, Winnipeg.
REPORT NO ISBN-0-86497-001-3
PUB DATE 81
NOTE 156p.

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Basic Skills; Drills (Practice); *Educational Games; Enrichment Activities; Instructional Materials; Junior High Schools; *Learning Activities; Mathematical Enrichment; Mathematics Curriculum; *Mathematics Instruction; Puzzles; Resource Materials; Secondary Education; *Secondary School Mathematics; Teaching Methods
IDENTIFIERS Manitoba Department of Education

ABSTRACT

This document was designed as a supplement to the mathematics guide for grades 7 through 9 also put out by the Manitoba Department of Education. It is a collection of projects, puzzles, demonstrations, games, and exercises which may be used to present concepts, provide practice, or encourage creative work. Teachers are encouraged to select various items from the the collection and integrate them into their existing programs. A separate section of suggested activities is listed for each of grades 7, 8, and 9. Each grade level has activities grouped according to concept or skill focus. Each activity includes a title, objective, a suggested number of pupils, additional sources for ideas, notes to teachers, and a description. The document closes with an annotated bibliography, which has sections for periodicals, books, and a listing of publishers and authors. (MP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED219255

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
  Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

SE038257

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
K.A. Cosens

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IDEAS AND ACTIVITIES

for

7-9 MATHEMATICS

Manitoba Department of Education

1981

I. INTRODUCTION

This document is designed to supplement the 7-9 Mathematics guide. It is a collection of projects, puzzles, demonstrations, games and exercises which may be used to present concepts, to provide practice, or to encourage creative work. Teachers are encouraged to select various items from this collection and to integrate them into their existing programs.

II. ACKNOWLEDGEMENTS

Appreciation is extended to the following teachers who contributed the ideas and activities found in this document:

Lucille Bisignano	River Heights Junior High School Winnipeg School Division No. 1
Gert Johansson	Arthur Day Junior High School Transcona-Springfield School Division No. 12
Connie Newman	Lincoln School St. James-Assiniboia School Division No. 2
Bill Rhoda	Andrew Mynarski School Winnipeg School Division No. 1
Connie Shaver	Spring Valley Junior High School St. James-Assiniboia School Division No. 2
Garry Slobodian	Queen Elizabeth School Norwood School Division No. 8
Gerry Strempler	Chief Peguis Junior High School River East School Division No. 9
Marlene Treichel	Elmwood High School Winnipeg School Division No. 1
Barb Verrall	Beliveau Junior High School St. Boniface School Division No. 4

The adaptation of these ideas and activities was undertaken by Carl Cunningham who has taught at schools in Boissevain and Rivers as well as in the Department of Mathematics and the Faculty of Education at Brandon University.

For their assistance in editing the final draft, the following are gratefully acknowledged: Gerry Strempler, Chief Peguis Junior High School, River East; Barb Verrall, Beliveau Junior High School, St. Boniface; and Carolyn Wilkinson, Fort Richmond Collegiate, Fort Garry School Division No. 5.

III. NOTES ON THE USE OF THIS DOCUMENT

A. Rationale

Designed as a source "book" of ideas and activities, this collection is intended to help teachers plan mathematics programs that can meet the varied interests and needs of their students - whether those needs be for the reinforcement of previously acquired skills, insights into dealing with everyday life, individualized instruction or more challenging materials. Teachers are encouraged to place this collection in a binder and to supplement the activities provided here with material drawn from their own experiences.

B. Ideas and Activities

The ideas and activities in this collection have been used in the classroom and are recommended by the teachers who submitted them. Teachers are advised to use only those activities assigned to the grade level of their particular class(es). Otherwise, students could be exposed to the same activity in more than one grade, and the novelty or freshness of the activities would be destroyed.

C. Notes on Format

In the upper right-hand corner of the first page of each activity is a guide to the classification of that activity. Generally, the reference consists of three lines – the first denoting grade level; the second identifying whether the activity involves "Concept Development," "Skill Development," or "Enrichment"; and the third, listing the section in the curriculum guide to which the activity is keyed. Consider the following example:

Grade /
Skill Development
Whole Number System

Those activities classified "Concept Development" can be used to introduce the concepts involved; those identified as "Skill Development" can be used to reinforce previously acquired skills; and those labelled "Enrichment" can be used to introduce a number of concepts which may not be encountered in the regular mathematics program. Enrichment activities are not intended solely for gifted students but can be modified and used with most students in an attempt to heighten motivation.

In most cases, the material presented is addressed directly to teachers. The exception is the Description section which contains the exercise or activity proper, written with the intent of giving direction to students.

Some activities have a section labelled Additional Ideas containing the names of authors and books in which similar or supplemental material may be found. More complete reference information is found in the Bibliography.

TABLE OF CONTENTS

I. INTRODUCTION

II. ACKNOWLEDGEMENTS

III. NOTES ON THE USE OF THIS DOCUMENT

IV. ACTIVITIES FOR GRADE 7

V. ACTIVITIES FOR GRADE 8

VI. ACTIVITIES FOR GRADE 9

VII. BIBLIOGRAPHY

ACTIVITIES FOR GRADE 7

GENERAL

Activity 7-1	Math Puzzle of the Week - I
Activity 7-2	Mathematics Tournament
Activity 7-3	Numbers in Our World
Activity 7-4	Calculator Craze

I. WHOLE NUMBER SYSTEM

Activity 7-5	Number Puzzles - I
Activity 7-6	$100 Words
Activity 7-7	Remainder Game
Activity 7-8	Math Toss

II. ALGEBRA

Activity 7-9	Break the Code

III. NUMBER THEORY

Activity 7-10	Taxman
Activity 7-11	"BUZZ" - A Number Game
Activity 7-12	LCM Rummy
Activity 7-13	Perfect Numbers
Activity 7-14	Factor Frazzle
Activity 7-15	Fibonacci Numbers

IV. FRACTIONS

Activity 7-16	Fraction Crossnumber Puzzle

V. DECIMAL FRACTIONS

Activity 7-17	Power Roller with Decimals

VI. RATIO AND PROPORTION

Activity 7-18	Newspaper Ad
Activity 7-19	My Room - I

VII. PERCENT

Activity 7-20 Fractionation

VIII. GEOMETRY AND MEASUREMENT

Activity 7-21 The Geoboard - I
Activity 7-22 The Geoboard - II
Activity 7-23 Paper Folding - I
Activity 7-24 Body Measurement
Activity 7-25 My Room - II
Activity 7-26 Geometric Shapes
Activity 7-27 Polyominoes
Activity 7-28 Construction Exercise: Tetrahedron and Cube
Activity 7-29 Line Designs - I
Activity 7-30 A Simple Puzzle

IX. GRAPHING

Activity 7-31 Olympic Winners
Activity 7-32 My Pulse
Activity 7-33 Coordinate Pictures

IV. Activities for Grade 7

Grade 7
Enrichment

Activity 7-1

Title: Math Puzzle of the Week - I

Objective: The situations presented in these puzzles provide an opportunity for the development of logical reasoning and encourage an interest in mathematics.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas:
NCTM Publications (Arithmetic Teacher; The Mathematics Teacher)
Puzzle Books
Math Contests

Notes to Teachers: At the beginning of the week, provide the class with a mathematics puzzle either written on a chalkboard or given as a handout. The problem involved should be one which is not likely to be answered immediately but rather is likely to require some reflection. It need not be directly related to the material currently under discussion in the mathematics course. Read the puzzle to the class and, perhaps, give a hint as to a possible approach. At the end of the week acknowledge and discuss correct solutions given by members of the class.

The following samples of mathematics puzzles, together with possible solutions, may be useful.

Description:

A. Arrange nine dots in the form of a square as shown in the figure. Draw four line segments which pass through every dot exactly once without retracing any segment or lifting the pencil before completing the drawing.

B. How can a 24 litre can of water be divided evenly among three people using unmarked cans with capacities of 5, 11 and 13 litres?

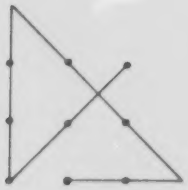
C. Eleven toothpicks are arranged to form five triangles:

1. Remove one toothpick to show four triangles.
2. Remove two toothpicks to show four triangles.
3. Remove two toothpicks to show three triangles.
4. Remove three toothpicks to show three triangles.

Activity 7-1

Possible Solutions:

A.



B. Fill the 13 litre container and use it to fill the 5 litre container. Pour the remaining 8 litres into the 11 litre container. Empty the 5 litre container back into the 24 litre can. There are now 16 litres in the largest can. Now, fill the 13 litre can and use this water to fill the 5 litre container. Pour these 5 litres into the remaining 3 litres in the 24 litre can. Thus, there are 8 litres of water in each of the 11, 13 and 24 litre cans.

C. 1.

2.

3.

4.

Activity 7-2

Title: Mathematics Tournament

Objective: Short, competitive exercises of this sort can provide an interest in mathematics.

Number of Students: Suitable for an entire class working in groups of three to four students each

Materials: Signs to designate the events
Stop watch

Source: Connie Shaver, Spring Valley Junior High School, St. James-Assiniboia School Division No. 2

Notes to Teachers: For the tournament select several activities, each of which can be completed in approximately 5 minutes. Some suggestions are: puzzles, games, word searches, sequences and problems.

Divide the class into groups and give clear and concise directions as to how they will proceed through the events. For example, Group I could start with Event I while Group II starts with Event II, etc. After 5 minutes each group moves to the next event in numerical order. After all groups have been rotated through the events, tally the scores.

Award points for each event and some kind of recognition for the best scores.

Following is an example of one event for a tournament.

Event #1: Perplexing Puzzle Panorama

Rules:

1. Each team member is to be given a sheet containing three puzzles and is to work independently of the others to arrive at the solutions to them. Each player then inserts the answers to the puzzles in the expression found at the bottom of the page. Once that is done, the sheet is to be handed over to the referee. Time limit: 5 minutes.

2. The score that a team receives is determined by the number of team members who compute the correct solutions to the expression at the bottom of the sheet. Points are awarded according to the following chart:

Number of Team Members Correct	Team Points
4	10
3	7
2	5
1	1

Activity 7-2

Puzzle Sheet:

1. What is the next number in the following sequence?
   24 12 36 24 48 36 ___

2. A certain banker tests applicants for the position of teller by posing this problem: "Here is a cheque for $63. Give me that amount in 6 bills, but do not give me any $1 bills." If the applicant cannot solve this problem in 30 seconds, he doesn't get the job.

   Question: What is the number of bills of the smallest denomination needed to solve the problem?

3. Divide seventy by one-half and add eight. What is the answer? ____

Expression to be evaluated:

$$\square \div \square + \square = ____$$

Answer to 1 — Answer to 2 — Answer to 3

Solutions:

1. The sequence could follow one of the following patterns:

   a. - 12, + 24, - 12, + 24, - 12, + 24, so the next number is 60.
   b. - 12, x 3, - 12, x 2, - 12, x 1, so the next number is 36.

   Other solutions are possible.

2. One $50 bill, one $5 bill and four $2 bills. Therefore the answer is 4.

3. $70 \div \frac{1}{2} + 8 = 148$

Expression to be evaluated:

$60 \div 4 + 148 = 163$
or $36 \div 4 + 148 = 157$

Activity 7-3

Title: Numbers in Our World

Objective: This project can be used to illustrate the frequency with which numbers occur in the environment.

Number of Students: Suitable for the entire class working as individuals

Materials:
Magazines
Catalogues
Newspapers

Description:

A. Make a bulletin board display by collecting pictures which show numbers; for example, 7-Up, 7-Eleven.

B. For one day keep a record of the numbers that you see, where you see them, and what they represent. What is the largest number you have found?

C. Make a list of the various ways numbers are used to identify people. Some examples are social insurance numbers, birthdays and telephone numbers:

	Social Insurance No.	Birth Date	Telephone No.
Sam Smith	123-456-789	54 10 04	111-0000

D. Select one of the identification systems listed below and determine

1. what the numbers (and letters) represent,
2. what patterns are involved,
3. what purpose the identification system serves,
4. what improvement could be made.

Identification Systems:

house numbers
section-township-range numbers
car and truck licence numbers
model and serial numbers

Notes to Teachers: Other examples for Part C are:

postal code
credit card number
height
weight
sports record
seat location in class (coordinate system)
home location (house number, rural route number, section-township-range number)

Grade 7
Skill Development

Activity 7-4

Title: Calculator Craze

Objective: These exercises provide a review of operations, exponents and equation solving as well as practice in using a calculator.

Number of Students: Suitable for the entire class working as individuals

Materials: Calculators (2 or 3 students may share one if necessary)

Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

Description: Using a calculator, find the appropriate numbers to put in the boxes:

1. $\square \overline{)568}$ (4)

2. $\square \overline{)6615}$ (27)

3. $2\frac{1}{2} \times 7 = \square$

4. $7 \times 3^{2} = \square$

5. $7^{2} \times 7^{4} = \square$

6. $2^{1} \times 2^{5} = \square$

7. $\frac{4^{3}}{4^{2}} = \square$

8. $\frac{450}{25} = \square$

9. $\frac{741}{13} = \square$

10. $\frac{\square}{53} = 12$

11. $4^{3} \times 4^{4} \times 4^{2} = \square$

12. $89 - 0.567 = \square$

13. $1^{17} = \square$

14. $5^{9} = \square$

15. $5.6 \times \square = 50.4$

16. $(6-4)^{3} = \square$

17. $27.8 + \square = 79.9$

18. $685 \div \square = 137$

19. $8^{\square} = 4096$

20. $\square - 0.25 = 82.75$

21. $(5+6)^{2} + (8-2)^{3} = \square$

Activity 7-4

22. $0.58 + 83 + \frac{7}{10^{\square}} = \square$

23. $2^{\square} \times 2^{3} = 2^{8}$

24. $\frac{3^{7}}{3^{\square}} = 3^{5}$

25. $\frac{2056}{\square} = 514$

Activity 7-5

Title: Number Puzzles - I

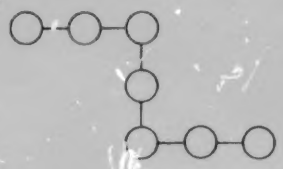
Objective: The following puzzles provide practice in the addition of whole numbers as well as an opportunity for developing problem-solving skills.

Number of Students: Suitable for the entire class working as individuals

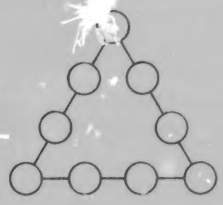
Materials: Copies of puzzles

Description: For each of the puzzles below, arrange the specified numbers in the circles so that the sums of numbers along a straight line are the same. The numbers to be used vary from one puzzle to another.

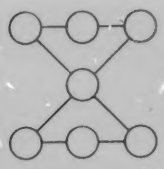
A. Use the numbers 1 through 7.



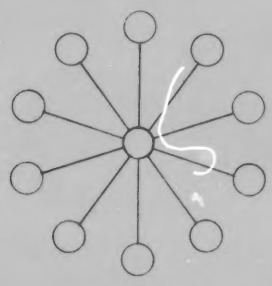
B. Use 1 through 9.



C. Use 1 through 7.



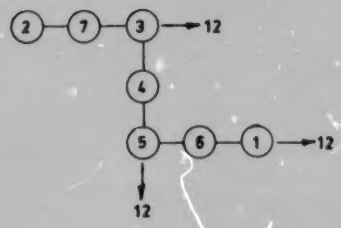
D. Use 1 through 11 in such a way that the sum along any straight line is 18.



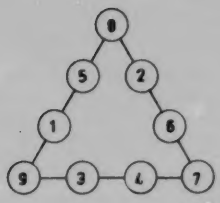
Activity 7-5

Possible Solutions:

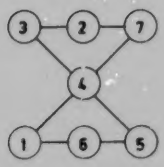
A.



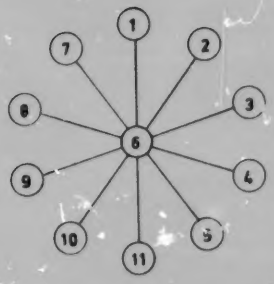
B.



C.



D.



Note: For similar puzzles see Activity 8-6.

Activity 7-6

Title: $100 Words

Objective: This puzzle provides practice in the addition of whole numbers.

Number of Students: Suitable for the entire class working as individuals

Source: S.A.G. Conference 1978 - Session by Jesse Rudnick, Temple University

Description: Assign a dollar value to each letter of the alphabet according to its position in the alphabet as shown in the following chart.

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

The dollar value of a word is to be calculated by adding the values of the letters of the word. Some examples are:

HOLIDAY: 8 + 15 + 12 + 9 + 4 + 1 + 25 = $74

PRIZES: 16 + 18 + 9 + 26 + 5 + 19 = $93

Find as many words as possible with a value of $100. One such word is NUTTY = 14 + 21 + 20 + 20 + 25 = $100

Notes to Teachers: When a student finds a $100 word, include the word and the finder's name on a list posted in the classroom. In your presence, have the student perform the addition to verify the dollar value.

To make this search more interesting, offer a small prize for each $100 word found. Also post a list of $99 and $.01 words to encourage students who have found words close to $100.

Activity 7-7

Title: Remainder Game

Objective: This game provides practice in the division of whole numbers.

Number of Students: 2 per game

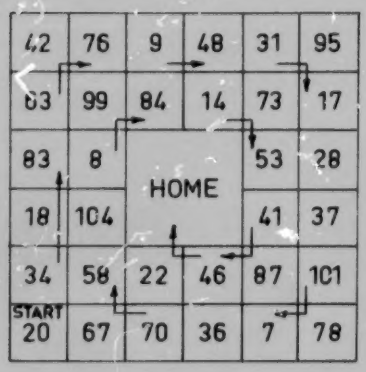
Materials: One game requires a playing board, a spinner and 2 identifying markers.

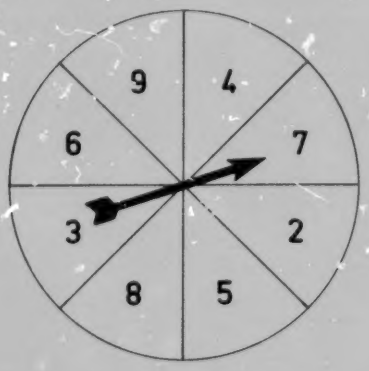
Description: From cardboard at least 15 cm square, prepare a playing board as shown in the diagram.

To begin the game, the players place their markers on START, and the player who is to play first spins the spinner. Then he divides the number on which his marker rests by the number to which the spinner points. He moves his marker the number of spaces in the remainder. For example, if, in the first play, the spinner points to 8, the player divides 20 by 8 and obtains 2 with a remainder of 4. Therefore he moves his marker 4 spaces to the space numbered 63. On his next turn, if the spinner points to 3, he divides 63 by 3, obtaining 21 with a remainder of 0. Thus his marker remains on 63.

Play alternately until one player reaches HOME. If a player is 3 spaces from HOME any remainder of 3 or greater is sufficient to reach HOME.

To encourage accuracy, a player who makes a mistake in finding a remainder should lose that turn.





Grade 7
Skill Development
Whole Number System

Activity 7-8

Title: Math Toss

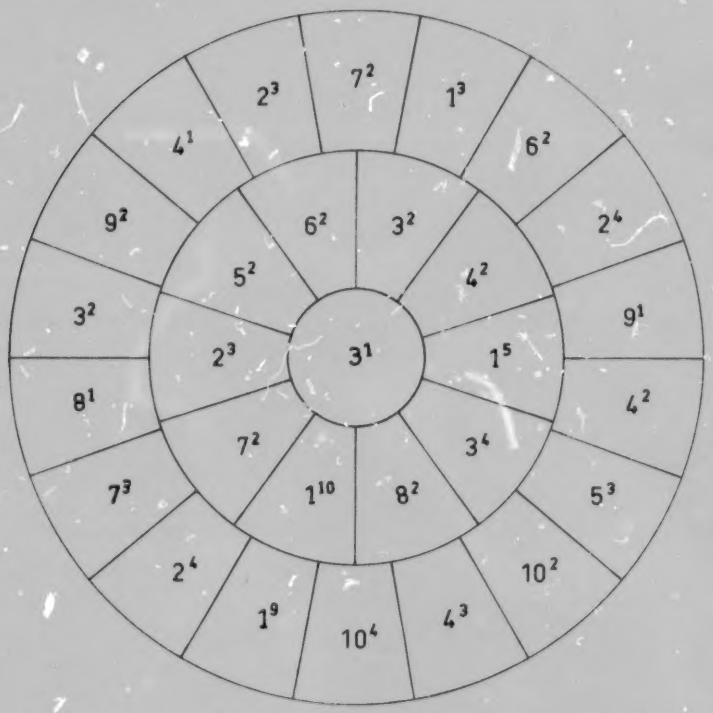
Objective: This game provides practice with operations involving powers.

Number of Students: 2 or 3 players per game board

Materials:
Cardboard
2 discs (bingo chips, coins, etc.)
Calculator (if desired)

Source: Marlene Treichel, Elmwood Junior High, Winnipeg School Division No. 1

Notes to Teachers: Have students make cardboard gameboards using the diagram below as an example:



Description: Toss the 2 discs on the board and add the values of the two powers which the discs cover. Count this answer as your score.

After taking a certain number of turns or playing for a certain length of time, add the scores (with a calculator, if desired) to determine a winner.

Activity 7-8

Adaptation:

Practice with other operations may be obtained by changing the rule to subtracting, multiplying or dividing the powers which the discs cover.

Grade 7
Skill Development
Algebra

Activity 7-9

Title: Break the Code

Objective: This puzzle provides practice in evaluating open number phrases.

Number of Students: Suitable for the entire class working as individuals

Description: "What did the big firecracker say to the little firecracker?"

The following code gives the answer to this question:

3	4	15	11	15	1	17	37	1	27	27	12	24	14

29	6	2	4	11	19	24	15	11	15

To break the code, evaluate each of the following expressions using the indicated value for the unknown. Each time the answer appears in the code, write the corresponding capital letter above it.

P.	$4x + 3$	if $x = 3$
G.	$7t - 1$	if $t = 4$
N.	$8 - 3b$	if $b = 2$
H.	$3 + 5a - 9$	if $a = 7$
T.	$11 + 2c - 7$	if $c = 5$
O.	$3y + 8$	if $y = 1$
B.	$8m + m + 1$	if $m = 4$
I.	$17 - 8t$	if $t = 2$
Y.	$14 - 5s$	if $s = 2$
S.	$a - 7 + 2a$	if $a = 8$
A.	$18 - 4x$	if $x = 3$
M.	$43 - 8y$	if $y = 5$
U.	$16 + 3k$	if $k = 1$
R.	$3 + 7d$	if $d = 3$
E.	$2 + 3f + 1$	if $f = 3$

Note to Teachers: The answer is:
"MY POP IS BIGGER THAN YOUR POP."

Activity 7-10

Title: Taxman

Objective: This contest provides an effective way to introduce prime numbers.

Number of Students: Suitable for the entire class as a group

Source: G. Slobodian, Queen Elizabeth School, Norwood School Division No. 8

Notes to Teachers: Ask someone from your class to take part in a contest with you, the Taxman. The rest of the class will be observers.

Put the numbers 1 to 30 on the chalkboard. Each of these numbers may be used as points exactly once. The person who obtains the most points wins.

Taking turns, you will each select a number from the list and receive that number of points. Allow the student to choose first. He will probably choose 30, so cross out 30. Then inform the class that there is another rule for the contest which states that the opponent receives points for all factors of the number chosen except the number itself. (Make a joke of this and you may get away with it.) Therefore you, the Taxman, receive 1, 2, 3, 5, 6, 10 and 15. Cross out each of these numbers and award their sum, 42, to yourself. Thus after one turn the score is: Student 30, Taxman 42.

Since you have the next choice, choose 29. The student will receive no points since the only factor of 29 other than itself is 1, and it has already been crossed out. Whenever possible, choose a prime number and you will easily win the game.

When the game is finished, have the students discuss the numbers chosen by the taxman.

Activity 7-11

Title: "BUZZ" - A Number Game

Objective: This game provides practice in recognizing multiples of a whole number.

Number of Students: Suitable for the entire class as a group

Notes to Teachers: Choose a whole number between 2 and 9 (for example, 7) and call it the "BUZZ" number. Have the students stand around the outside of the room and decide upon an order for them, that is, who will be first, second, third, etc.

The game is played by having the students count in order, that is, the first student says "one," the second says "two," etc. If a student's number, (for example, 14), is a multiple of the BUZZ number (7), the student must say BUZZ rather than the number. If the student's number has the BUZZ number as one of its digits, (for example, 17), the student must also say BUZZ. If a student makes a mistake, he is out of the game and must return to his seat. The last player standing wins the game.

It is recommended that someone be responsible for checking the accuracy of the responses.

The game may be varied by having a two digit BUZZ number (e.g., 12) or by having a pair of BUZZ numbers (e.g., 4 and 7).

Activity 7-12

Title: LCM Rummy

Objective: This game provides practice in identifying the least common multiple of a set of whole numbers.

Number of Students: 2 or 3 players per game

Materials: 40 blank playing cards
Red and blue felt pens

Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

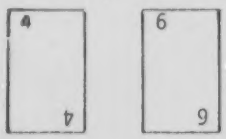
Notes to Teachers:

1. Prepare the 40 playing cards as follows:

   a. in red ink write the following LCM's on 14 playing cards: 18, 12, 91, "Wild," 56, 15, 27, 9, 3, 8, 39, 20, 72 and 12;

   b. in blue ink write the following factors on 26 cards: 4, 6, 5, 13, 3, 8, 9, 3, 9, 4, 1, 7, 3, 3, 13, 8, 27, 5, 4, 3, 4, 8, 1, 7, 6, 9.

   Examples:



2. The game is played according to the rules of Rummy. A player can lay cards down if the numbers in red are multiples of those in blue. If, for instance, a player has two or more numbers in blue with their LCM in red, he can lay down all the appropriate cards.

Activity 7-13

Title: Perfect Numbers

Objective: This exercise provides practice in identifying the divisors of a number.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: W.T. Stokes, Notable Numbers.

Description: The number 6 is a rather special one since it is the sum of its divisors (exluding 6 itself), that is, 1 + 2 + 3 = 6. If a number satisfies the property that it is the sum of its divisors (except for the number itself), it is called a perfect number.

Can you find another perfect number?

Perfect numbers are rare. There is only one with one digit and only one with two digits.

Notes to Teachers: The five smallest perfect numbers are:

6
28
496
8128
33 550 336

Depending upon the interest and abilities of the students, you may wish to set some limits upon the numbers to be considered. For example, you might suggest finding all perfect numbers less than 30 (or 50).

It is interesting to observe whether students notice that they can eliminate primes and powers of a single prime.

Activity 7-14

Title: Factor Frazzle

Objective: This game provides practice in writing a composite number as a product of prime numbers.

Number of Students: 2 or 3 students per game

Materials:
9 cubes with blank faces
67 bingo chips
Felt pen

Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

Notes to Teachers: Write the following numbers on the faces of the 9 cubes: 51, 91, 4, 12, 16, 18, 39, 9, 111, 6, 15, 10, 98, 42, 243, 63, 70, 45, 18, 16, 8, 75, 12, 14, 56, 210, 196, 100, 250, 90, 40, 16, 54, 24, 81, 36, 125, 30, 27, 20, 40, 105, 25, 51, 22, 14, 26, 27, 68, 74, 52, 57, 44, 34.

Prepare the bingo chips as follows:

2 with number 17	1 with number 19
2 with number 37	4 with number 13
1 with number 11	8 with number 7
12 with number 5	13 with number 3
24 with number 2	

Description: The game is played as follows:

Each player rolls one cube to determine who plays first. The person with the highest number begins. The first player rolls all the cubes and takes any 2 chips from the pile. He places the chips under a number (or numbers) to make part of that number's prime factor phrase.

Play continues with each player taking 2 chips in turn until prime factor phrases have been made for all 9 numbers.

If a player completes a factor phrase, he earns the value of the composite number on the face of the cube. The player with the highest total wins.

Activity 7-15

Title: Fibonacci Numbers

Objective: This sequence of numbers provides the opportunity for a student to search for patterns.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: W.T. Stokes, Notable Numbers.
I. Adler, Mathematics - Golden Library of Knowledge.

Description: A very interesting sequence of numbers arose from a problem stated by Leonardo (commonly known as Fibonacci) of Pisa, Italy. In a book published in 1202, he proposed the following problem:

> Suppose that a pair of rabbits produce a new pair in their second month and in every succeeding month. (In their first month rabbits are too young to produce offspring. If no rabbits die and each pair is productive, how many pairs can be produced from a single pair? (Give the number of pairs at the beginning of each month.)

A chart such as the one below may be helpful in arriving at the sequence which gives the solution to the problem.

Month	Pairs At Beginning Of Month	Non-Producing Pairs At Beginning Of Month	Pairs Born During Month
1	1	1	0
2	1	0	1
3	2	1	1
4	3	1	2
5	5	2	3
6	8	3	5
7	13	5	8

The numbers which solve the problem form the sequence:
1 1 2 3 5 8 13...
These numbers are called the Fibonacci Numbers.

Patterns in the Fibonacci Number Sequence

Notice that this is an infinite sequence of natural numbers in which each term after the first two is the sum of the previous pair of terms.

1 1
1 + 1 = 2
1 + 2 = 3
2 + 3 = 5
3 + 5 = 8
5 + 8 = 13...

Activity 7-15

Consider another pattern obtained by finding the sum of the first "n" Fibonacci numbers; that is, for 1 term the sum is 1; for 2 terms the sum is 2; for 3 terms the sum is 4, etc. This produces the sequence:

1 2 4 7 12...

When this sequence is compared to the Fibonacci sequence:

1 1 2 3 5 8 13

one can see that the sum of the first "n" terms is 1 less than the (n+2) term.

Can you find any other patterns in the Fibonacci sequence?

Activity 7-16

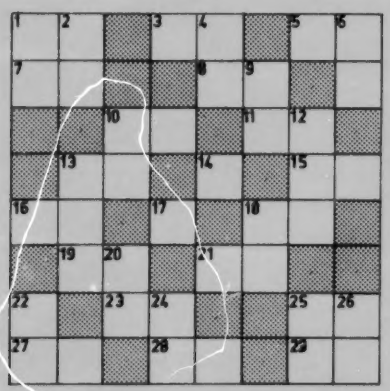
Title: Fraction Crossnumber Puzzle

Objective: This puzzle provides practice with operations involving fractions as well as review of some terminology.

Number of Students: Suitable for the entire class working as individuals

Materials: Graph paper with large squares to make reading easier

Description: Using the same procedure as in a crossword puzzle, complete the following:



Across

1. $\frac{3}{4} \times 16$
3. $2\frac{2}{3} \times 21$
5. $19\frac{1}{4} - 3\frac{1}{4}$
7. $3\frac{1}{7} \times 14$
8. $6 \div \frac{1}{2}$
10. $95\frac{1}{3} - 8\frac{2}{6}$
11. $\frac{3}{4}$ of 64
13. $4\frac{1}{8} \div \frac{3}{8}$
14. $4 \div \frac{1}{2}$
15. $10\frac{1}{2} \times 4$
16. $42\frac{6}{8} - 8\frac{3}{4}$
17. $\frac{2}{3} \div \frac{4}{6}$
18. $6\frac{2}{3} = \frac{\square}{3}$
19. Denominator of $\frac{5}{6} \times \frac{13}{4} \times \frac{1}{2}$

Down

1. $\frac{1}{3}$ of 42
2. $\frac{2}{3} \times 36$
4. $15\frac{1}{4} = \frac{\square}{4}$
6. LCD for $\frac{1}{5}, \frac{1}{4}, \frac{1}{3}$
9. Denominator of $\frac{1}{3} \times \frac{5}{8}$
10. Denominator of $(\frac{1}{3})^4$
12. $9 \div \frac{3}{28} \times 10$
13. LCD for $\frac{5}{9}, \frac{3}{16}$
18. $8\frac{3}{9} \div \frac{1}{3}$

Activity 7-16

Down

20. Denominator of $\frac{5}{12} \times \frac{5}{7}$

22. $4\frac{2}{7} \div \frac{5}{21}$

24. $\frac{3}{8} \times \frac{4}{5} \times 106\frac{2}{3}$

25. $2\frac{4}{7} + 8\frac{3}{7}$

26. Denominator of $\frac{5}{11} \times \frac{3}{8}$

Across

21. $8\frac{1}{4} + 2\frac{3}{4} + 4$

23. $\frac{2}{5} \times \frac{5}{8} \times 172$

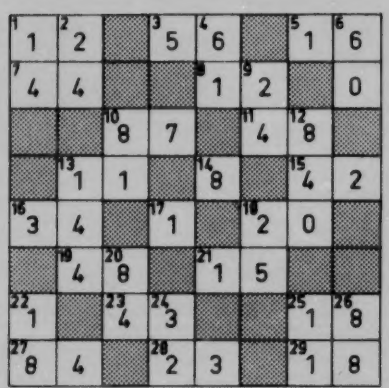
25. $\frac{3}{8} \times 1\frac{1}{7} \times 42$

27. LCD for $\frac{3}{4}$, $\frac{5}{7}$, $\frac{2}{3}$

28. $15\frac{3}{5} + 7\frac{2}{5}$

29. $27\frac{4}{5} - 9\frac{8}{10}$

Solution:



Adaptation:

Varying the number system and the degree of difficulty makes cross-number puzzles useful practice for students in Grades 8 and 9.

Activity 7-17

Title: Power Roller with Decimals

Objective: This game provides practice in multiplying and dividing a decimal fraction by a power of 10.

Number of Students: 2 or 3 students per game board

Materials:
Cardboard (or heavy paper)
3 markers
3 cubes (commercially made or constructed as in Activity 7-28)

Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

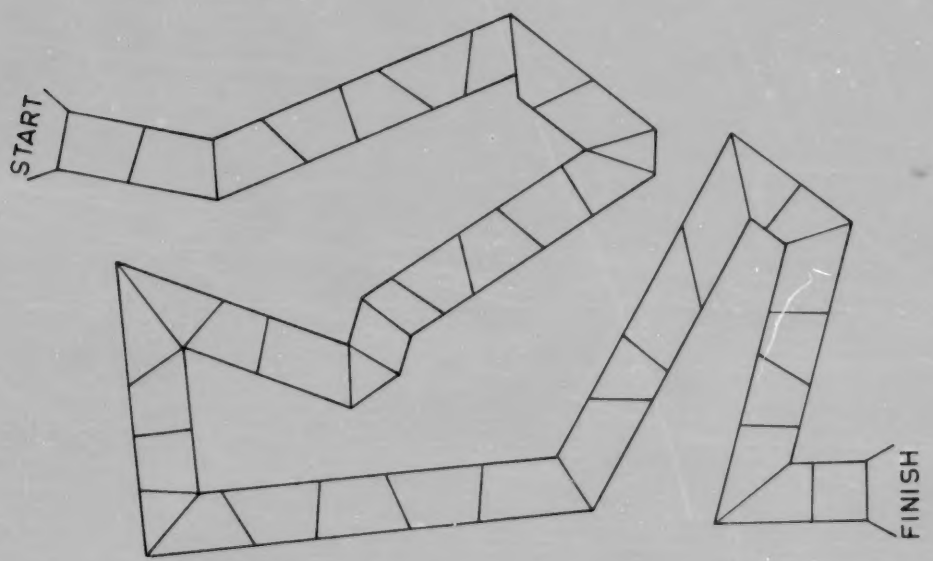
Notes to Teachers: A suggested set of values for the faces of the cubes are as follows:

Cube 1: 2.5, 0.376, 25.8, 26, 1.57, 0.3

Cube 2: $\div$, $\div$, $\div$, x, x, x

Cube 3: 1000, 10^4, 10^2, 10^3, 10, 100

Have students use cardboard to make game boards as shown in the following example.



Instead of moving a marker along a game board, players could receive points for correct answers.

Activity 7-17

Description:

Roll the power cube to determine which player will start first. Then, each player, in turn, rolls all 3 cubes together and calculates the decimal answer correctly within 30 seconds. The order of the expression to be evaluated is Cube 1, Cube 2, Cube 3. Do not move the cubes until the opponents have an opportunity to verify the answer. A correct answer entitles a player to move 2 spaces on the game board. The first player to reach FINISH wins.

Activity 7-18

Title: Newspaper Ad

Objective: These exercises concerning consumer buying provide practice in unit pricing as well as checking change received.

Number of Students: Suitable for the entire class working as individuals

Materials: Grocery advertisements from newspapers

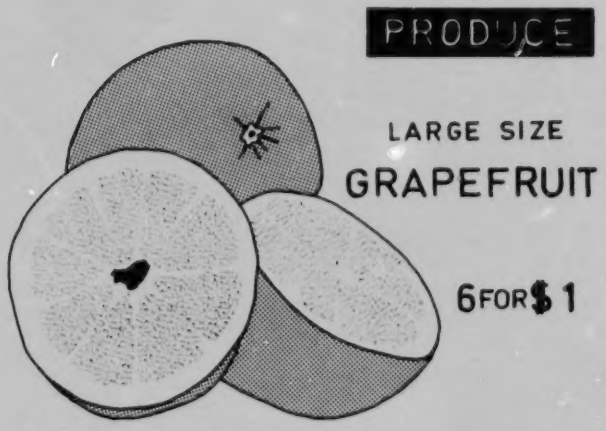
Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

Notes to Teachers: Advertisements in newspapers are an excellent source of practical mathematics questions.

Description:

A. From a grocery advertisement select 5 items, each of which costs less than $1.00. Cut out these items and paste them on a large sheet of paper. Write the cost below each item. If you give the clerk $1.00 for each item, how much change would you get back?

B. Consider the following advertisement:



1. What would be the cost of 1 grapefruit?
2. What would be the cost of 3 grapefruit?
3. What would be the cost of 5 grapefruit?

C. Grace's family loves macaroni and cheese for lunch. The local grocery store advertises 3 packages for 89¢ or a case of 48 packages for $13.99. How much will Grace save per package by buying a case of 48?

Activity 7-19

Title: My Room - I

Objective: The preparation of a scale drawing provides practice in taking measurements and using proportions.

Number of Students: Suitable for the entire class working as individuals

Materials:
Metre stick (or metric tape)
Graph paper
Straightedge

Notes to Teachers: Discretion should be used with this exercise since the size of a student's room at home may be a sensitive issue. Classrooms, seminar rooms or hallways in the school could easily be measured instead.

Description:

A. Using a metre stick or a metric tape, determine the following measurements of your bedroom. Have these measurements verified by a parent.

Length of room	_____
Width of room	_____
Width of doorway	_____
Width of closet door	_____
Depth of closet	_____

_____
Parent's signature

B. Using an appropriate scale, make a scale drawing of your room on graph paper. Show the location of the door and the closet.

Activity 7-20

Title: Fractionation

Objective: This game provides drill in identifying equivalent expressions (fractions, decimals and percents).

Number of Students: 2 or 3 students per game

Materials: 20 blank cards per game
(any heavy paper or cardboard cut into uniform rectangles will suffice)

Notes to Teachers: Using the 20 cards, prepare sets of equivalent expressions. Two possibilities are:

10 sets of 2 cards each:

$\frac{1}{2}$	and	0.5
$\frac{3}{4}$	and	0.75

etc.

5 sets of 4 cards each:

$\frac{1}{2}$	0.5	50%	and	$\frac{50}{100}$
$\frac{7}{8}$	0.875	87.5%	and	$\frac{14}{16}$

etc.

Description: Place the cards face down in a 4 by 5 array. The first player turns over two cards. If they are equivalent, the player keeps the cards and turns over two more. If they are not equivalent, the cards are returned to their original positions, and the play passes to the next player.

After all of the cards have been paired, the player with the most cards is the winner.

Activity 7-21

Title: The Geoboard - I

Objective: This set of exercises may be used to illustrate slides, flips and turns.

Number of Students: Suitable for the entire class working as individuals or in pairs

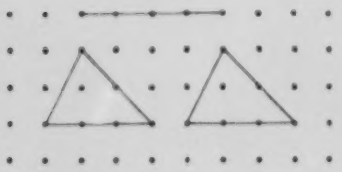
Materials: Geoboards (or dot paper) - one board for each student or pair of students
Elastic bands

Additional Ideas: J.J. Del Grande, Geoboards and Motion Geometry for Elementary Teachers.

Description:

A. Slides (Translations)

With an elastic, form a triangle on the geoboard. Using another elastic, show the image of the triangle under a slide of 4 units to the right. You may find it useful to use another elastic to show the length and direction of the slide as in the following diagram.



Repeat this exercise for a slide of 5 units to the right and 3 units down.

B. Flips (Reflections)

On the geoboard, indicate a triangle and a vertical "flip line" or "reflecting line." Using another elastic, show the image of the triangle under this flip.

Activity 7-21

Repeat this exercise using:

1. a horizontal flip line.
2. a line at an angle of 45° from the vertical.

C. Turns (Rotations)

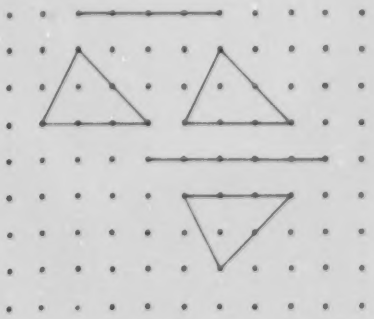
Indicate a triangle and show its image after a one-half turn about one of its vertices.

Repeat this exercise for:

1. a one-quarter turn about a vertex.
2. a one-quarter turn about a point which is not one of the vertices of the triangle.

D. Combinations

Indicate a triangle and show the image of the triangle under a slide of 4 units to the right followed by a flip over a horizontal line. One such combination is shown in the diagram.



Repeat this exercise for some other combination of slides, flips or turns.

Activity 7-22

Title: The Geoboard - II

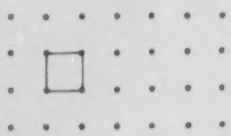
Objective: These exercises may be used to reinforce the concept of area.

Number of Students: Suitable for the entire class working as individuals or in pairs

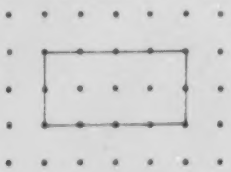
Materials: Geoboards (or dot paper) - one board for each student or pair of students
Elastic bands

Additional Ideas: J. Niman and R. Postman, Mathematics on the Geoboard.
J.J. Del Grande, Geoboards and Motion Geometry for Elementary Teachers.

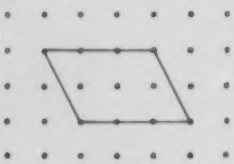
Description: For the unit of area in the following exercises, use a unit square on the geoboard.



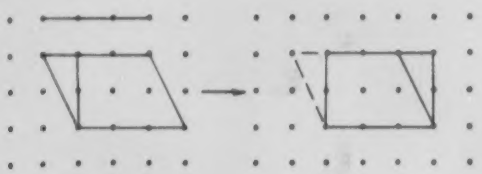
A. With an elastic, form a rectangle on the geoboard. Determine its area by counting the unit squares.



B. Form a parallelogram and find its area.



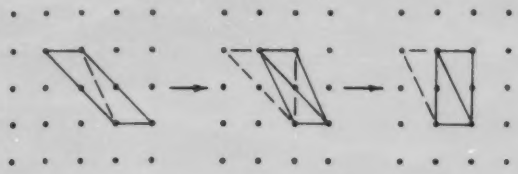
One technique for finding the area is to identify a triangular region within the parallelogram and perform a slide upon it as in the following diagram.



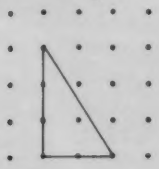
Activity 7-22

The area of the rectangle can be found by counting. Hence, the area of the parallelogram is determined.

In certain cases, this technique has to be applied more than once.



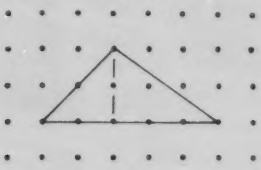
C. Form a right triangle and determine its area.



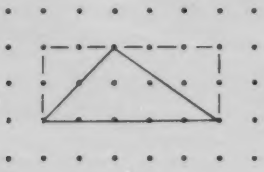
If the triangle is given a half-turn about the midpoint of the side opposite the right angle, a rectangle is identified. The area of the rectangle can be determined by counting. The area of the triangle is one-half the area of the rectangle.

D. Form a scalene triangle and find its area. Some hints for finding the area are:

1. "break up" the triangle into right triangles, or

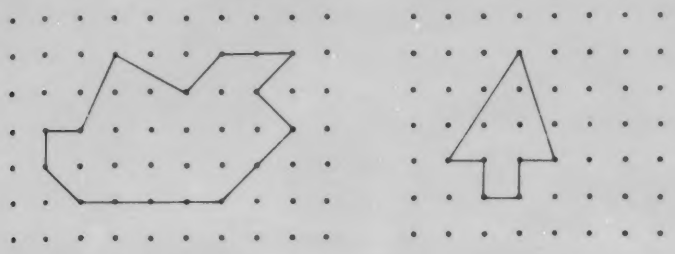


2. subtract from the area of a larger rectangle.



Activity 7-22

E. On the geoboard, form regions similar to the following and find their areas.



Adaptation: In Grade 8 use area on the geoboard to justify the Pythagorean Relation.

Activity 7-23

Title: Paper Folding - I

Objective: These exercises provide practice with terminology as well as opportunity to explore some of the properties of geometric figures.

Number of Students: Suitable for the entire class working as individuals

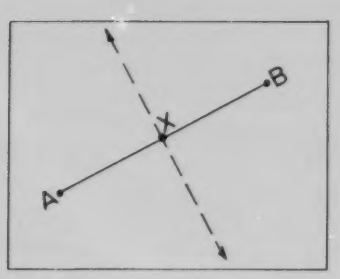
Materials:
Tracing paper
Scissors
Ruler
Protractor

Additional Ideas:
S. Krulik, A Mathematics Laboratory Handbook for Secondary Schools.
M.A. Sobel and E.M. Maletsky, Teaching Mathematics: A Sourcebook of Aids, Activities and Strategies.

Description:

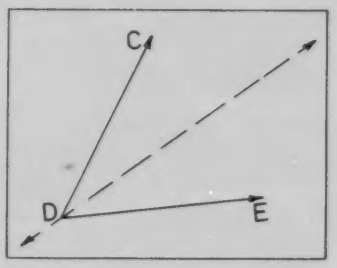
A. Perpendicular bisector

On a piece of tracing paper, indicate a segment AB. Fold the paper so that A falls on B. Draw a line along the crease. Name the point of intersection X. Using a protractor, measure the angles formed at X. Is the line perpendicular to $\overline{AB}$? Using a ruler, measure the segments AX and $\overline{XB}$. Does the line bisect $\overline{AB}$?



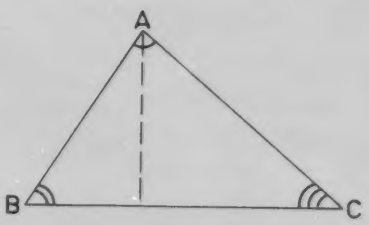
B. Angle bisector

Draw an angle $\angle CDE$ on a piece of tracing paper. Fold the paper so that ray DC falls on ray DE. Draw a line along the crease. Using a protractor, determine whether the line along the crease bisects $\angle CDE$.



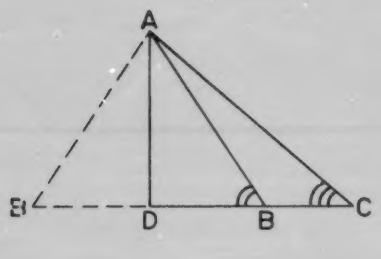
C. Angles of a triangle

Cut a triangle ABC from a piece of paper. Fold the paper through A so that B falls on $\overline{BC}$.



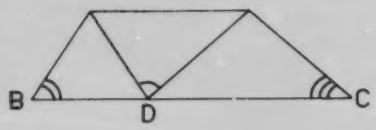
Activity 7-23

Call the point D where the crease intersects $\overline{BC}$.

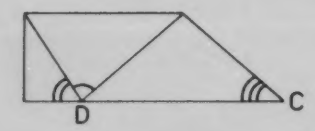


Straighten out the paper and then make 3 folds so that:

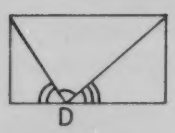
A falls on D



B falls on D



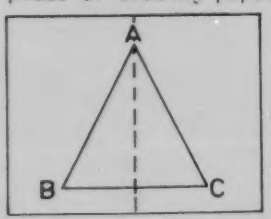
C falls on D



What conclusion can you make about the sum of the measures of the angles of a triangle?

D. Lines of symmetry

1. On a piece of tracing paper, draw an equilateral triangle ABC. Fold the paper so that A is on the crease and $\overline{AB}$ falls on $\overline{AC}$.



Since the portions of the triangle on each side of the crease are the same, the line along the crease is called a line of symmetry. How many other lines of symmetry can you find for this equilateral triangle?

How many lines of symmetry has an isosceles triangle which is not equilateral?

For a scalene triangle, how many lines of symmetry are there?

Activity 7-23

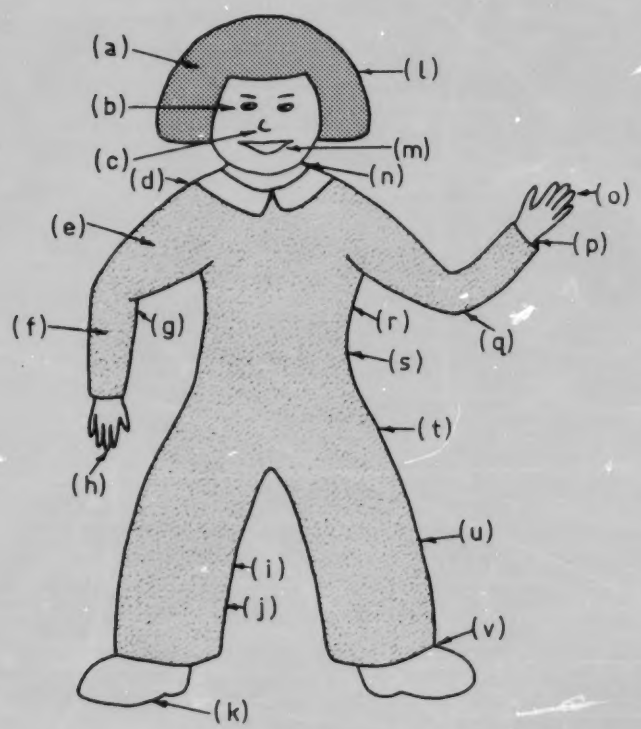
2. Draw a square on tracing paper. Fold the paper to determine the number of lines of symmetry.

   How many lines of symmetry has a rectangle which is not a square?

3. Draw some geometric figures which you believe to have lines of symmetry. Test by folding the paper.

Activity 7-24

Title:	Body Measurement
Objective:	This exercise provides practice in measurement in metric units.
Number of Students:	Suitable for the entire class working in pairs
Materials:	One 100 cm measuring tape for each pair of students
Notes to Teachers:	Provide each student with a copy of the following chart. Have each student record his/her body measurements in centimetres.



Activity 7-24

a.	hair length (longest)	a._____
b.	eyes (distance between)	b._____
c.	nose length	c._____
d.	back (width across shoulders)	d._____
e.	bicept (around)	e._____
f.	forearm (length)	f._____
g.	sleeve length (underarm to wrist)	g._____
h.	finger (length of longest)	h._____
i.	inseam (crotch to ankle)	i._____
j.	calf (around)	j._____
k.	foot length	k._____
l.	hat size	l._____
m.	width of mouth	m._____
n.	neck (around)	n._____
o.	ring finger (around)	o._____
p.	wrist	p._____
q.	arm length (shoulder to finger tip)	q._____
r.	chest	r._____
s.	waist	s._____
t.	hips	t._____
u.	leg length (waist to heel)	u._____
v.	ankle	v._____

Activity 7-25

Title: My Room - II

Objective: This project illustrates the use of area calculations in a real life situation.

Number of Students: Suitable for the entire class working as individuals

Materials: Metre stick or metric tape
Catalogues or newspapers

Description: A sum of $300.00 has been given you to redecorate your room. This redecorating may include painting, wallpapering, and carpeting as well as replacing curtains and light fixtures. Will $300.00 be sufficient?

A. The following measurements are necessary to calculate the amount of materials needed for the job:

Length of room _____
Width of room _____
Height of room _____
Width of window _____
Height of window _____
Width of doorway _____
Height of doorway _____
Width of closet door _____
Height of closet door _____
If your room is not a perfect rectangle, include any other pertinent dimensions: _____
_____
_____

B. Using a catalogue or newspaper ads, select the materials necessary for the redecoration. You may find the following outline useful. Be prepared to indicate how you arrived at the number of units of each item.

Description	Name of Store	Number of Units	Unit Cost	Total Amount
			Sub Total	
			Provincial Sales Tax	
			Total	

Notes to Teachers: Students may require some assistance in the ordering of paint and wall paper. As noted in "My Room - I," this kind of exercise may create difficulties for some students. It should be used with discretion or adapted for other situations such as converting a classroom into a student lounge.

Activity 7-26

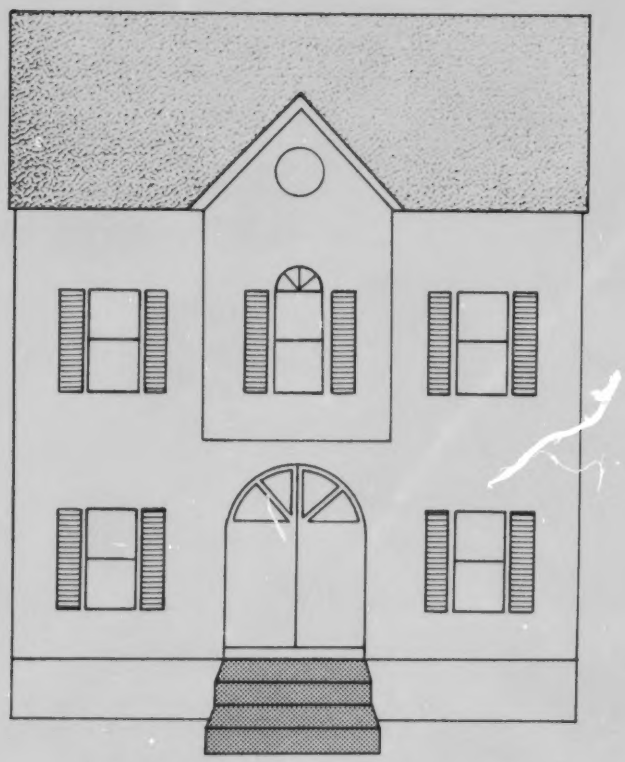
Title: Geometric Shapes

Objective: This project requires students to observe and identify geometric shapes in our daily lives.

Number of Students: Suitable for the entire class working as individuals or in small groups

Additional Ideas: W.B. MacLean, et al., Mathaction 7.

Description: Within two blocks of the school, find examples of the use of geometric shapes in the design and construction of buildings. Using photos, sketches, or diagrams, prepare a report on your findings.



Activity 7-27

Title: Polyominoes

Objective: These exercises are an investigation of ways to arrange certain geometric shapes.

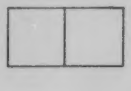
Number of Students: Suitable for the entire class working in pairs

Materials: Graph paper with large squares (approximately 2 cm)

Description:

A. Introduction: A polyomino is a set of squares joined along their edges. The simplest form, a single square, is called a monomino. There is only one type of monomino:

Two squares joined with one side in common are called a domino. There is only one type of domino:



Three connected squares are called a triomino. These can be arranged in two different ways.

If 4 squares are joined, the resulting figure is called a tetromino. Find all different arrangements of tetrominoes. (There are five.)

A pentomino is formed from 5 squares. Using graph paper, cut out one of each of the different arrangements of pentominoes. You should have 12 different ones.

B. Pentomino Problems. In the 12 pentominoes, there are 60 small squares. Try to arrange the 12 pentominoes to form a 6 by 10 rectangle.

Other rectangles are possible; for example: 5 x 12, 4 x 15, 3 x 20. Try to form them.

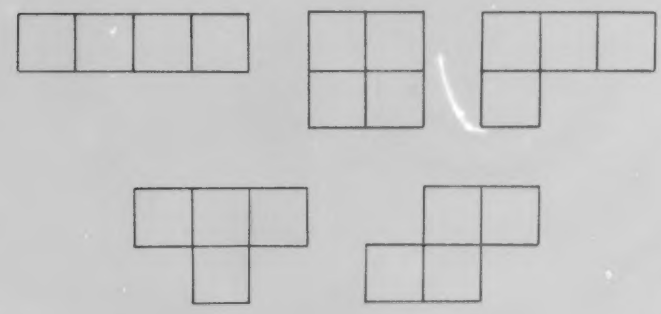
Activity 7-27

C. Pentomino Game. This is a game for 2 (or more) players which requires the 12 pentominoes and a chess board with squares the same size as the pentominoes. An 8 x 8 square of graph paper could also be used.

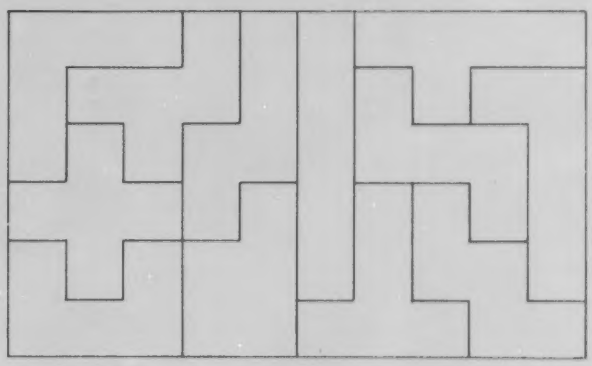
Each player in turn chooses a pentomino and places it on the board in any available space. One pentomino will cover 5 squares. The last person to place a pentomino on the board, so that no further pieces can be placed without overlapping, wins. The game can be completed in a minimum of five and a maximum of 12 moves.

Notes to Teachers:

A. The 5 tetrominoes are:



B. The 12 pentominoes in the form of a 6 by 10 rectangle are:



Activity 7-28

Title: Construction Exercise: Tetrahedron and Cube

Objective: The patterns below may be used to construct models to assist in discussion of 3-dimensional geometry.

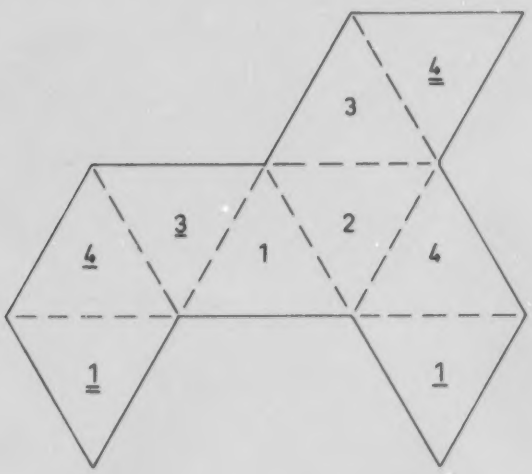
Number of Students: Suitable for the entire class working as individuals

Materials: Ruler
Scissors

Additional Ideas: Patterns for other polyhedra (3-dimensional solids) may be found in many sources, for example: R.G. Stein, Mathematics: An Exploratory Approach.

Description: The patterns below may be used to construct models without the use of glue or tape.

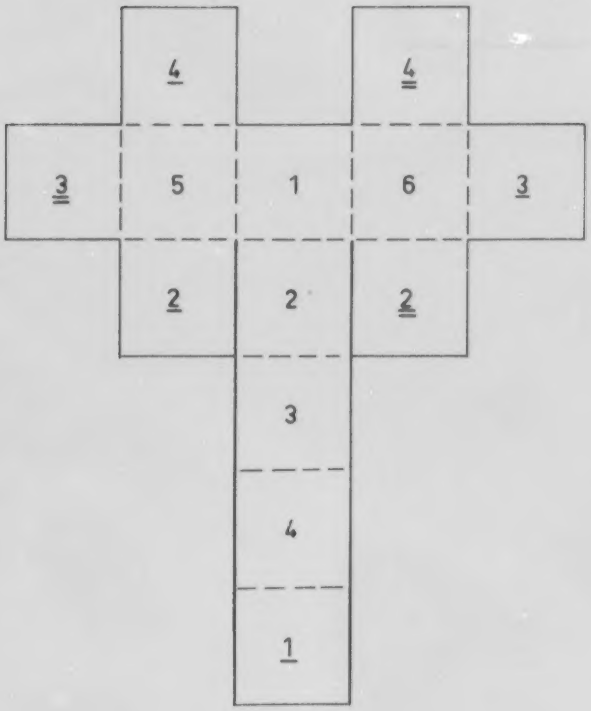
Tetrahedron



Cut along the solid line segments and fold along the dotted ones. Slide face 1 under face 1. Then tuck faces 1, 4 and 3 inside faces 1, 2 and 4 so that 1 is under 1 and 4 is under 4. Finally, tuck face 4 behind face 4.

Activity 7-28

Cube



Cut along the solid line segments and fold along the dotted ones. Slide faces 2 and 2 under face 2. Fold face 3 over faces 3 and 3 and face 4 over faces 4 and 4. Finally, tuck face 1 behind face 1.

Notes to Teachers:

A calendar page that is divided into squares is particularly convenient for making the pattern for a cube.

Activity 7-29

Title: Line Designs - I

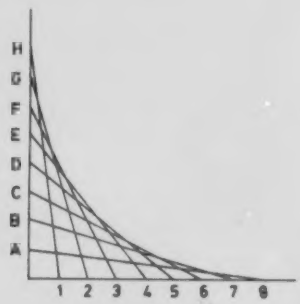
Objective: The construction of line segments can produce interesting geometric patterns.

Number of Students: Suitable for the entire class working as individuals

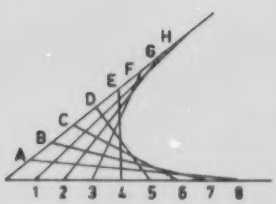
Materials:
White or coloured paper
Felt pens or coloured pencils or pens
Ruler
Protractor

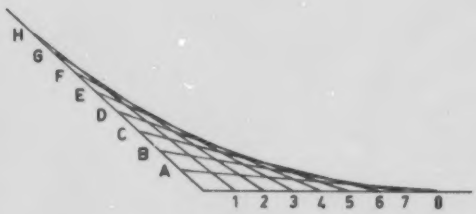
Additional Ideas: D. Seymour, L. Silvey, J. Snider, Line Designs.

Description: Draw a right angle and mark off from the vertex 8 segments of equal length along each ray. (Either a compass or a ruler may be used to obtain equal lengths.) Label the endpoints of the segments as in the following diagram and connect A to 8, B to 7,..., H to 1.



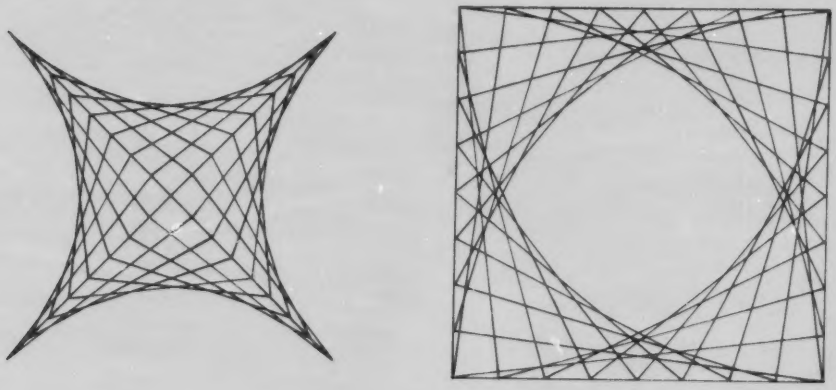
Next, try the same procedure with an acute angle and then an obtuse angle.





Activity 7-29

Create patterns of your own by combining some designs. Some samples are included below.



Interesting effects can be obtained by shading parts of the designs.

Activity 7-30

Title: A Simple Puzzle

Objective: This puzzle requires manipulation of geometric shapes.

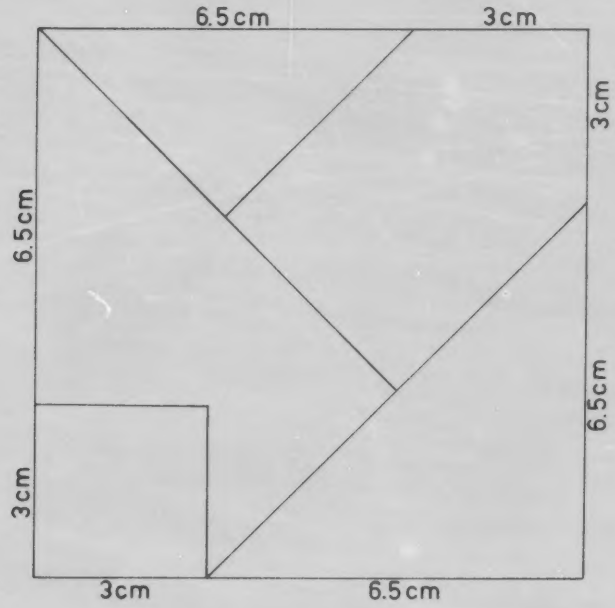
Number of Students: Suitable for an individual

Materials: Cardboard (or heavy paper)
Ruler
Scissors

Additional Ideas: Puzzling Puzzles, Yale Series.

Description: Mark a 9.5 cm by 9.5 cm piece of cardboard as shown in the diagram and cut along the line segments. Separate the portions and, without looking at this diagram, reassemble the square.

Give the pieces to another person and ask him or her to make a square from them.



Activity 7-31

Title: Olympic Winners

Objective: This assignment provides practice in collecting data and in constructing and interpreting a bar graph.

Number of Students: Suitable for the entire class working as individuals

Materials:
Coloured pens or pencils
Ruler
Other resources - access to the results of the Olympic Games through television, radio or newspaper reports

Source: Lucille Bisignano, River Heights Junior High School, Winnipeg School Division No. 1

Description: Obtain information about the winners of the various events at the Olympic Games. For Canada, the United States, the U.S.S.R., and one other country, determine the number of gold, silver and bronze medals each has won.

Construct a bar graph to illustrate the data collected. Show each of the gold, silver and bronze medals separately.

Notes to Teachers: To determine whether students can interpret information from a bar graph, either in individual interviews or within the context of group discussion, ask questions such as the following:

A. Which country won the most

1. gold medals?
2. silver medals?
3. bronze medals?

B. Which country won the least

1. gold medals?
2. silver medals?
3. bronze medals?

C. How many gold medals were won by the U.S.S.R.?

D. How many silver medals were won by the U.S.A.?

E. How many medals were won by Canada?

The format of this assignment can be used for other games such as the Canadian Winter Games, the Commonwealth Games, etc.

Grade 7
Skill Development
Graphing

Activity 7-32

Title: My Pulse

Objective: This procedure involves collecting data and constructing a line graph.

Number of Students: Suitable for the entire class working in pairs

Materials: Stop watches (or watches with second hands)

Additional Ideas: J. Fair and K. Rand, Handy Math: Focus on Sports.

Notes to Teachers: Make sure that the students know how to determine pulse rate, either at the wrist or the neck, that is, by counting the number of beats for 15 seconds and multiplying by 4.

Description: Your pulse rate can provide you with information about your health.

In the following procedure, you will find your pulse rate when at rest and after a period of exertion to measure the speed at which your heart recovers its regular rate of beating. After each step, take your pulse rate (always when seated) and record it on the chart.

STEP		PULSE RATE (BEATS PER MINUTE)
A.	Sit for 3 minutes.	_____
B.	Stand and sit 10 times.	_____
C.	Sit for 3 minutes.	_____
D.	Touch your toes 10 times.	_____
E.	Sit for 3 minutes.	_____
F.	Jump 20 times, clapping your hands above your head.	_____
G.	Sit for 3 minutes.	_____
H.	Run on the spot for 1 minute.	_____
I.	Sit for 3 minutes.	_____
J.	Sit for another 3 minutes.	_____

Using the information that you recorded, draw a line graph. The graph will illustrate changes in your pulse rate and the speed at which your heart recovers.

Resting pulse rates vary greatly from one individual to another but will likely be in the range of 60-75 beats per minute.

Activity 7-33

Title: Coordinate Pictures

Objective: This exercise provides practice in reading coordinates and plotting points.

Number of Students: Suitable for the entire class working as individuals

Materials: Graph paper
Straightedge

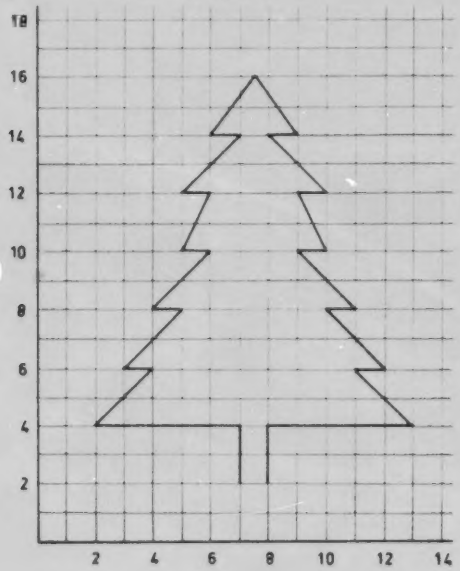
Description: Complete the three parts of the following assignment. This is an opportunity to display your originality, neatness and accuracy.

A. On a piece of graph paper, draw the coordinate axes with the vertical axis at the left side of the paper and the horizontal axis at the bottom. Then draw a picture on the graph paper using straight line segments (avoid curved lines).

B. On a separate paper, record all pertinent coordinates for your picture. List them in the order in which they are to be connected.

C. Have another person reproduce your picture by plotting and joining the coordinates you have listed in B.

The following is a simple example:



The coordinates to be connected are: (8, 2), (8, 4), (13, 4), (11, 6), (12, 6), (10, 8), (11, 8), (9, 10), (10, 10), (9, 12), (10, 12), (8, 14), (9, 14), (7.5, 16), (6, 14), (7, 14), (5, 12), (6, 12), (5, 10), (6, 10), (4, 8), (5, 8), (3, 6), (4, 6), (2, 4), (7, 4), (7, 2).

Adaptation: For Grade 8, have students use all four quadrants.

V. Activities for Grade 8

ACTIVITIES FOR GRADE 8

GENERAL

Activity 8-1	Math Puzzle of the Week - II
Activity 8-2	Banking
Activity 8-3	Venn Diagrams
Activity 8-4	Paper Clip Pitch
Activity 8-5	Probability Toss

I. WHOLE NUMBER SYSTEM

Activity 8-6	Number Puzzles - II
Activity 8-7	Sequences
Activity 8-8	$1 000 000 Words
Activity 8-9	Pascal's Triangle
Activity 8-10	Goldbach's Conjecture

II. INTEGERS

Activity 8-11	Picture Puzzle
Activity 8-12	"I Have" Cards
Activity 8-13	Nomographs

III. ALGEBRA

IV. RATIONAL NUMBERS

Activity 8-14	The Better Buy

V. RATIO AND PERCENT

Activity 8-15	My Room - III
Activity 8-16	Research Topics
Activity 8-17	Breakfast Menu

VI. GEOMETRY

Activity 8-18	The Area of a Circle
Activity 8-19	How Many Cubes?

VI. GEOMETRY (Cont'd.)

Activity 8-20	Metric Measurement Collage
Activity 8-21	Tessellations - I
Activity 8-22	Tessellations - II (The Regular Tessellations)
Activity 8-23	A Model of an Icosahedron
Activity 8-24	Tangrams

VII. COORDINATE GRAPHING

Activity 8-25	Picture Plotting
Activity 8-26	Battleships
Activity 8-27	Graphing Temperatures

Activity 8-1

Title: Math Puzzle of the Week - II

Objective: The situations presented in these puzzles provide an opportunity for the development of logical reasoning and encourage an interest in mathematics.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: NCTM Publications (Arithmetic Teacher; The Mathematics Teacher)
Puzzle Books
Math Contests

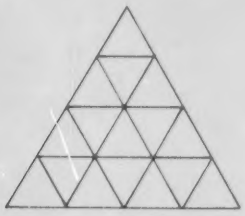
Notes to Teachers: At the beginning of the week, provide the class with a mathematics puzzle either written on a chalkboard or given as a handout. The problem involved should be one which is not likely to be answered immediately but rather is likely to require some reflection. It need not be directly related to the material currently under discussion in the mathematics course. Read the puzzle to the class and, perhaps, give a hint as to a possible approach. At the end of the week acknowledge and discuss correct solutions given by members of the class.

Following are some samples of puzzles together with possible solutions.

A. Before you on a table are eight white pills and a balance scale. The pills are identical except that one contains a deadly poison and is slightly heavier than the others. You must swallow seven of the pills. You may use the balance only twice to determine which is the poisoned pill. Can you do it?

B. A gardener wants to plant ten trees in such a way that there will be five rows with exactly four trees in each row. How can he do it?

C. How many different triangles are in this figure?



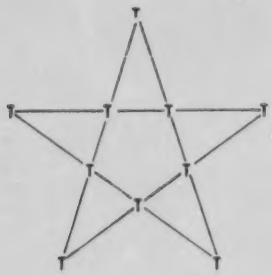
Solutions:

A. Take 6 of the pills and place 3 of them on each side of the balance. If they balance the poisoned pill must be one of the two remaining pills and can be identified by using the balance a second time. If they do not balance, consider the 3 pills which are the heavier. Take 2 of the 3 and place one on each

Activity 8-1

side of the scale. If they balance, the remaining pill is the poisoned one. If they do not balance, the heavier one must be the poisoned one.

B.



C. Count all triangles 1, 2, 3, or 4 units high. The number of such triangles are 16, 7, 3 and 1, respectively, for a total of 27.

Activity 8-2

Title: Banking

Objective: This activity provides practice in the reading and writing of whole numbers.

Number of Students: Suitable for the entire class working as individuals

Materials: Blank cheques
Deposit forms

Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

Notes to Teachers: Kits containing sample (non-negotiable) cheques and deposit slips are available from the Bank of Commerce for class use. If regular bank cheques are to be used, they should be marked "not negotiable" across the face.

Provide a few examples of partially completed forms such as the following:

NO. _____

_____ 19____

PAY TO THE ORDER OF Handy Furniture Company $ 1954.89

_____ 100 DOLLARS

V. G. Mathematician

DEPOSIT SLIP

☑ C/A
☐ P.C.A

DATE

ACCOUNT NUMBER 206-97

CREDIT ACCOUNT OF G. Mathematician

INITIALS Depositor | Teller

CASH RECEIVED - SIGNATURE

CASH	1246	05
CHEQUES AND/OR COUPONS	42	01
	6	53
SUB-TOTAL		
LESS CASH	200	00
NET DEPOSIT		

Activity 8-2

Have the students complete the forms, filling in whatever is missing.

Then provide exercises for the students to complete entire forms. The following are some examples:

A. You have purchased a bicycle from the A and B Bicycle Shop for $92.54. Figure out the 5% sales tax and add it to the price of the bicycle. Then write a cheque for the total amount.

B. Prepare a deposit slip for the following bills and coins:
one $10 bill
six $1 bills
fourteen 25¢ pieces
eleven 10¢ pieces
four 5¢ pieces

Grade 8
Enrichment

Activity 8-3

Title: Venn Diagrams

Objective: The following situation provides practice in problem solving.

Number of Students: Suitable for the entire class working as individuals

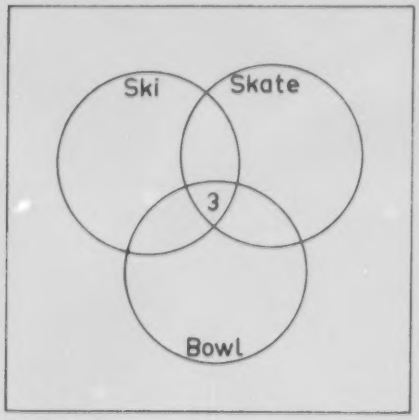
Description: Listed below are the results of a survey of 35 students regarding their participation in skiing, skating and bowling:

15 ski
22 skate
14 bowl
11 ski and skate
8 skate and bowl
5 ski and bowl
3 ski, skate and bowl

A. How many students do not participate in any of the 3 activities?

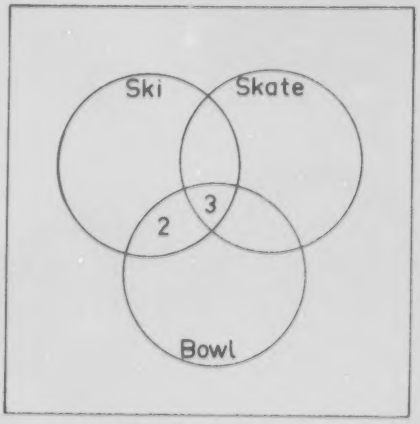
B. How many students participate only in skating?

Notes to Teachers: One possible approach to solving this problem is to use a Venn Diagram.



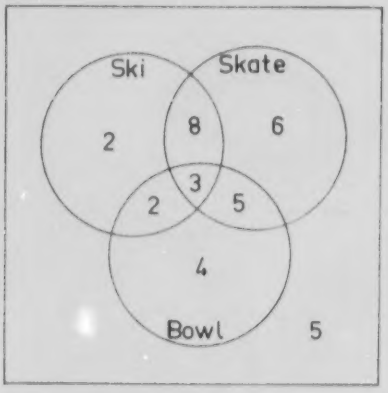
Begin by noting that 3 students ski, skate and bowl.

If 5 students ski and bowl, we can identify another number in the diagram.



Activity 8-3

Continuing in this manner we obtain:



A. 5 students do not participate.

B. 6 students participate only in skating.

Activity 8-4

Title: Paper Clip Pitch

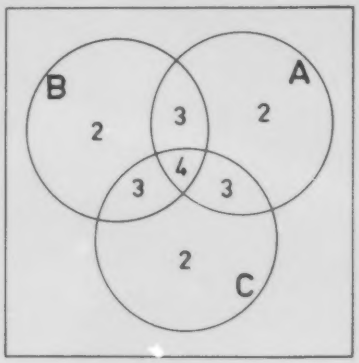
Objective: This game can be used as an introduction to the study of probability.

Number of Students: 1 to 4 students per game

Materials: Cardboard
Paper clips
Score sheets

Additional Ideas: D.Johnson, et al., Probability: Activities in Mathematics, First Course.

Notes to Teachers: Have students prepare game boards from pieces of cardboard as shown below. The cardboard should be at least 50 cm by 50 cm and the circles about 20 cm in diameter.



Prepare score sheets as in the diagram. Make enough copies so that each student can have one.

REGION OF BOARD	TALLY	FREQUENCY	NUMBER ON REGION	SCORE	FREQUENCY ÷ TOTAL TOSSES (EXPERIMENTAL PROBABILITY)	FREQUENCY PREDICTED FOR 100 TOSSES
A and B but not C						
A and C but not B						
B and C but not A						
A but not B or C						
B but not A or C						
C but not A or B						
A, B, and C						
Outside A, B, C						

Description: To begin the game, each player takes 10 paper clips and a score sheet. Taking turns, each player tosses a paper clip onto the board and then records the toss in the tally portion of the score sheet according to

Activity 8-4

the region of the board on which the paper clip lands. If a player misses the board with the paper clip, he/she must repeat the toss.

After the 10 tosses, each player completes the last 5 columns of the score sheet. The number written on each region indicates the number of points the player receives for each paper clip in that region. The score is determined by multiplying the frequency times the corresponding number for that region.

Activity 8-5

Title: Probability Toss

Objective: This exercise can be used as an introduction to the study of probability.

Number of Students: Suitable for the entire class working as individuals or in pairs

Materials: One coin per student
One die per student

Additional Ideas: W.B. MacLean, et al., Mathaction 7.

Description:

A. Flipping a Coin

Estimate the number of heads and the number of tails that would appear if a coin were flipped 50 times. Then take a coin and flip it 50 times. Use the following table to record your estimates and the actual results.

Side Appearing	Estimate	Tally	Total Times Side Appears (Frequency)	Fraction of Total Flips (Experimental Probability)
HEAD				
TAIL				

B. Rolling a Die

Estimate the number of times 1, 2, 3, 4, 5 or 6 would appear if a die were rolled 60 times. Then take a die and roll it 60 times. Use the following table to record your estimates and the actual results.

Side Appearing	Estimate	Tally	Total Times Side Appears	Fraction of Total Rolls (Experimental Probability)
1				
2				
3				
4				
5				
6				

Notes to Teachers: Experiments of this type may be used to initiate discussions of probability. This investigation can be extended by increasing the number of coins and dice used.

Activity 8-6

Title: Number Puzzles - II

Objective: The following puzzles provide practice in the addition of whole numbers as well as an opportunity for developing problem-solving skills.

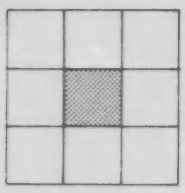
Number of Students: Suitable for the entire class working as individuals

Materials: Copies of puzzles

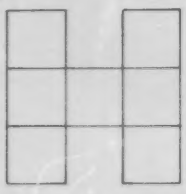
Description: For each of the puzzles below, arrange the specified numbers in the spaces of the diagram so that the sums of numbers along a straight line are the same. The numbers to be used may vary from one puzzle to another.

A. Use the numbers 1 through 6.

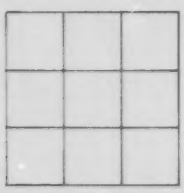
B. Use 1 through 8.



C. Use 1 through 7.

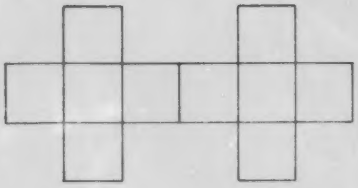


D. Use 1 through 9.



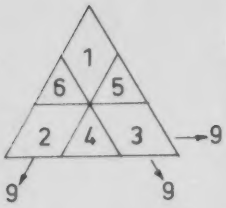
Activity 8-6

E. Use 1 through 10.



Possible Solutions:

A.



B.

1	5	6	→12
8		4	
3	7	2	→12
↓12		↓12	

C.

3		1
2	4	6
7		5

D.

2	9	4
7	5	3
6	1	8

E.

	10			9	
6	3	4	2	5	1
	8			7	

Note: For other puzzles of this type see Activity 7-5.

Activity 8-7

Title: Sequences

Objective: Exercises in recognizing patterns can provide practice with operations involving whole numbers.

Number of Students: Suitable for the entire class working as individuals

Description: Find the next 3 members of each of the following sequences by determining its pattern. State the rule for obtaining a term from the previous one(s).

		Rule
A.	24, 31, 38, 45, 52, ___, ___, ___	_____
B.	1, 3, 9, 27, 81, ___, ___, ___	_____
C.	81, 162, 54, 108, 36, ___, ___, ___	_____
D.	3, 9, 4, 10, 5, ___, ___, ___	_____
E.	0, 1, 3, 7, 15, 31, ___, ___, ___	_____
F.	2, 4, 10, 28, ___, ___, ___	_____
G.	3, 3, 6, 9, 15, ___, ___, ___	_____
H.	1, 2, 4, 5, 7, 8, 10, ___, ___, ___	_____
I.	0, 1, 2, 5, 26, ___, ___, ___	_____
J.	8, 4, 16, 8, 32, ___, ___, ___	_____
K.	3, 6, 5, 10, 9, ___, ___, ___	_____

Possible Solutions:

A. Add 7 to one term to obtain the next term.
B. Multiply by 3.
C. Multiply by 2, then for the next term, divide by 3. Repeat the rule.
D. Add 6, then subtract 5, and repeat.
E. Multiply by 2 and add 1; i.e., $2n + 1$.
F. Multiply by 3 and subtract 2; i.e., $3n - 2$.
G. Add the previous two terms.
H. Miss out every third natural number.
I. Multiply the term by itself and add 1; i.e., $n^2 + 1$.
J. Divide by 2, then multiply by 4, and repeat.
K. Multiply by 2, then subtract 1, and repeat.

Adaptation: In Grade 7, number sequences with whole numbers, fractions and decimals could be used.

In Grade 8, the integers and rationals could be used.

Activity 8-8

Title: $1 000 000 Words

Objective: This problem provides practice in the multiplication of whole numbers and in the use of prime numbers.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: Games Magazine (September/October 1977).

Description: Assign a dollar value to each letter of the alphabet according to its position in the alphabet as shown in the following chart.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

R	S	T	U	V	W	X	Y	Z
18	19	20	21	22	23	24	25	26

The dollar value of a word is to be calculated by multiplying the values of the letters of the word. For example, the value of the word "ART" is 1 x 18 x 20 = $360.

A. See if you can find any words with a value of $1 000 000. Write down the word you have found with a value closest to $1 000 000.

B. See if you can find any words with values that are a power of 10. Which of your words has the highest value?

Notes to Teachers: Announce the word with a value closest to $1 000 000 as well as the finder's name.

For B, encourage students to think in terms of prime factorizations. Since 10 = 2 x 5, the only letters which may be used are A, B, D, E, H, J, P, T and Y.

One word that satisfies the condition defined in B is "BETTY" since it has a value of 2 x 5 x 20 x 20 x 25 = $100 000.

Activity 8-9

Title: Pascal's Triangle

Objective: This array of numbers provides several patterns which students may be able to discover.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: W.T. Stokes, Notable Numbers.
D. Seymour, et al., Aftermath-Book 1.

Description: The array of whole numbers below is encountered in several areas of mathematics.

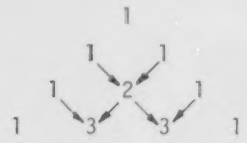
```
                1
              1   1
            1   2   1
          1   3   3   1
        1   4   6   4   1
      1   5  10  10   5   1
    1   6  15  20  15   6   1
```

This array, which may be extended indefinitely, is known as Pascal's Triangle and is named after the French mathematician Blaise Pascal (1623-1662) who wrote about this "triangle" and its properties.

Identify patterns which are satisfied by the numbers of this array.

Notes to Teachers:

A. A basic pattern is the one for obtaining the next row of the triangle: write a 1 at each end of the row and obtain each other entry by adding the pair of numbers above it at the left and right.



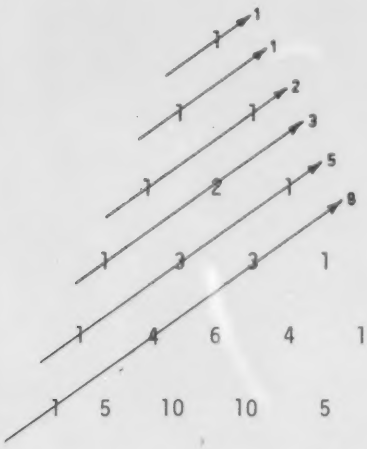
B. Consider the sums of the numbers in each row.

```
          1 = 1
        1 + 1 = 2
      1 + 2 + 1 = 4
    1 + 3 + 3 + 1 = 8
  1 + 4 + 6 + 4 + 1 = 16
```

The sum of a row is a power of 2. Also, the sum of one row is twice the sum of the previous row.

Activity 8-9

C. Consider the sums of the numbers along the direction indicated below:



In this case, the sums yield the Fibonacci numbers.

Activity 8-10

Title: Goldbach's Conjecture

Objective: This exercise will increase familiarity with prime numbers.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: W.T. Stokes, Notable Numbers.

Description: About 1742, Christian Goldbach suggested that every even number greater than 4 could be written as the sum of two odd prime numbers. This sum is not necessarily unique.

As examples we can note that $6 = 3 + 3$
$8 = 3 + 5$
and $10 = 5 + 5$
or $10 = 3 + 7$

Express each of the even numbers between 8 and 100 as a sum of two odd prime numbers.

Although the conjecture appears to be true for any even number, no formal proof has ever been discovered.

Solutions:

$12 = 5 + 7$ $14 = 3 + 11$
$16 = 3 + 13$ $18 = 5 + 13$
$20 = 3 + 17$ $22 = 3 + 19$
etc.
$100 = 11 + 89$

Activity 8-11

Title: Picture Puzzle

Objective: This puzzle provides practice with operations involving integers.

Number of Students: Suitable for the entire class working as individuals

Materials:
Pictures (for example, from old calendars)
Cardboard
Paper cutter
Glue

Description:
A. Select an attractive picture and mount it on a piece of cardboard.
B. Make a frame by mounting four strips on the edges of a second piece of cardboard that is the same size as the first.
C. On the back of the picture and the front of the frame, draw congruent, corresponding rectangles.
D. Write a problem in each rectangle on the back of the picture.
E. On the picture frame, write the answers; see the illustration below.
F. Cut the picture into rectangles and lay the pieces face down.
G. Reassemble the puzzle by matching problems and answers, placing the rectangles over the answers on the frame so that the picture side is up.

-2-4	3-8	4+2
5-5	-4+1	-2-2
2+5	-4+5	-3+8
9-6	-3-3	9-7
3(-3)	-16÷(-4)	12÷(-6)

6	-5	-6
-4	-3	0
5	1	7
2	-6	3
-2	4	-9

Notes to Teachers: To provide drill, have students put together each other's puzzles.

The numbers used in the puzzles may be varied to include fractions, decimals, percents, etc.

Activity 8-12

Title: "I Have" Cards

Objective: This game provides practice in the addition of integers.

Number of Students: Suitable for the entire class working as a group

Source: SAG Conference 1978 - Session by Jesse Rudnick, Temple University

Notes to Teachers: The following instructions will provide a game for 30 people.

Prepare a list of 30 addition questions involving integers in such a way that the answer to the first question is the first integer in the second question. The answer to the second question is the first integer in the third question, and so on.

A sample set of questions is:

1. -7 + 4 (the answer is -3)
2. -3 + 6 (the answer is 3)
3. 3 + (-2)
4. 1 + (-5)
5. -4 + 9
6. 5 + (-11)
7. -6 + (-3)
8. -9 + 7
9. -2 + (-3)
10. -5 + 11
11. 6 + (-7)
12. -1 + (-14)
13. -15 + 5
14. -10 + 23
15. 13 + (-2)
16. 11 + (-9)
17. 2 + (-14)
18. -12 + 16
19. 4 + (-20)
20. -16 + 3
21. -13 + 21
22. 8 + (-16)
23. -8 + 25
24. 17 + (-10)
25. 7 + (-18)

Activity 8-12

26. -11 + 20
27. 9 + (-22)
28. -13 + 13
29. 0 + (-14)
30. -14 + 7

Transfer this information to the 30 blank cards as follows:

Card 1: | I have -7. Who has my number plus 4? | since question 1 is -7 + 4.

Card 2: | I have -3. Who has my number plus 6? | since question 2 is -3 + 6.

Continue until all 30 questions have been used.

Distribute the cards at random. Have someone read his card and let the game progress according to the questions on the cards. Follow the students' progress according to the list of questions.

Adaptation: When the questions are changed, this game can accommodate other operations and number systems.

Activity 8-13

Title: Nomographs

Objective: This exercise provides drill and at the same time exposes students to a device for computing with integers.

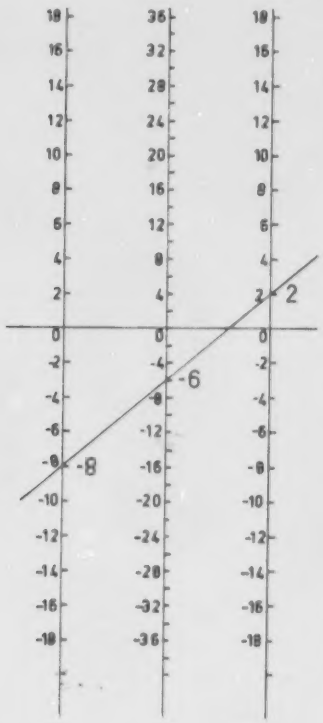
Number of Students: Suitable for the entire class working as individuals

Materials: Graph paper
Straightedge

Additional Ideas: M.A. Sobel and E.M. Maletsky, Teaching Mathematics: A Sourcebook of Aids, Activities, and Strategies.

Description: On graph paper, draw three parallel vertical line segments approximately 20 cm long and 3 cm apart.

As in the following diagram, mark scales on the segments with the outer two having units that are the same size and the middle segment having units half this size.



Activity 8-13

The device you have constructed is called a nomograph. It can be used for adding integers. To perform an addition, use a straightedge to line up the addends on the outer segments. Read the sum from the point at which the straightedge intersects the middle segment. The example shown in the diagram is -8 + 2 = -6.

Write down 10 addition questions involving integers and find the answers on the nomograph.

Can you explain why the nomograph gives the correct answer?

Activity 8-14

Title: The Better Buy

Objective: These exercises on unit pricing involve an application of mathematics to everyday life and can be of assistance in making decisions on food purchases.

Number of Students: Suitable for the entire class working as individuals

Materials: Food advertisements

Source: Lucille Bisignano, River Heights Junior High School, Winnipeg School Division No. 1

Description:

A. Suppose that you have gone to the grocery store to buy peanut butter and apple juice. Peanut butter is available at $2.43 for 1 kg or $3.49 for 1.5 kg, apple juice at 99¢ for 1.5 L or 29¢ for 350 mL.

Complete the following tables to determine unit prices and the quantity that is the better buy.

1. Peanut Butter

QUANTITY	PRICE	COST/kg
1 kg	$2.43	
1.5 kg	$3.49	

2. Apple Juice

QUANTITY	PRICE	COST/kg
1.5 L	$0.99	
350 mL	$0.29	

B. Select 4 different food items. For each item consult food advertisements in newspapers or visit grocery stores to obtain prices of various sizes and various brands.

Complete a table like the one below for each food item and determine which is the best buy for that particular item.

FOOD ITEM: _____

STORE	BRAND	SIZE	COST	UNIT PRICE

The Best Buy is _____

because _____

Note: Factors other than price may influence your decision as to the "Best Buy".

Activity 8-15

Title: My Room - III

Objective: This project provides practice in using proportions.

Number of Students: Suitable for the entire class working as individuals

Materials: Catalogues and newspapers
Graph paper

Notes to Teachers: Have students work through Activity 7-19, "My Room - I." As noted there, discretion should be used with this type of exercise so as to avoid embarrassment for individual students. The instructions below could easily be adapted for a number of different situations. One possibility would be to have students estimate the cost of transforming a classroom into a student lounge.

Description: Someone has offered to give you enough money to refurnish your room. The offer is conditional, however, on your giving an immediate (and reasonable) estimate of the amount you will need. What amount will you specify at this time?

A. Using catalogues and newspaper ads, select the furniture and complete the following table:

Item Description	Size	Name of Store	Number of Units	Unit Cost	Total Cost
				Sub Total	
				Provincial Sales Tax	
				Total	

B. Once the furniture has been selected, measurements must be taken to ensure that the pieces will fit in the room. Using the scale drawing of the room from Activity 7-19 "My Room - I," and the same scale, complete the following table and arrange the new furniture in the drawing.

Item	Size	Scale Size

Activity 8-16

Title: Research Topics

Objective: These projects illustrate the use of proportions in presenting information and making decisions.

Number of Students: Suitable for the entire class working as individuals

Materials: Library reference books

Additional Ideas: Mathematics Resource Project, Ratio, Proportion and Scaling.

Description:

A. Find the world records for the following track and field events:

RACE DISTANCE	TIME	
	WOMEN	MEN
100 metre		
400 metre		
1500 metre		
3000 metre		

Determine the speed for each race. Compare the rates of distance to time for the different events. What would you predict as a record time for a 6000 metre race?

B. Find the cost of airplane tickets from the airport nearest you to four other destinations in Canada. Determine the distance for each trip. Are the rates of cost to distance equivalent for the four trips?

Complete similar exercises for train and bus fares using the same locations.

For which method of travel are the rates most consistent?

Activity 8-17

Title: Breakfast Menu

Objective: This assignment involves the use of mathematics in a real life situation.

Number of Students: Suitable for the entire class working as individuals

Materials: Breakfast menus

Source: Connie Shaver, Spring Valley Junior High School, St. James-Assiniboia School Division No. 12

Notes to Teachers: If possible, have each student obtain a breakfast menu from a restaurant.

Description:

A. Using a menu, plan a breakfast for a family of six satisfying the following requirements:

1. The total cost of the breakfast must not exceed $16.00.
2. The two adults will have coffee and the four children will have orange juice.
3. One of the adults will have a breakfast costing more than $4.00.
4. A 5% sales tax will be calculated on each individual order over $4.00. Each member of the family is to have a separate bill.
5. Tips will not be included in the total cost.

B. Give a listing of each meal and its cost.

C. In case the family decides to leave a tip, figure how much it would be if it were 15% of the total cost; then figure the total cost including tip.

Grade 8
Concept Development
Geometry

Activity 8-18

Title: The Area of a Circle

Objective: This demonstration provides an argument to support $A = \pi r^2$ as a reasonable relationship for the area of a circle in terms of its radius.

Number of Students: Suitable for the entire class working as a group

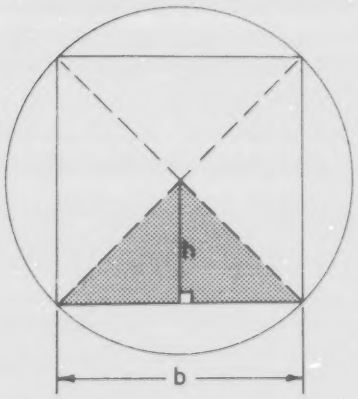
Materials: A set of models of a square, a regular pentagon, a regular hexagon and a regular octagon which can be inscribed in a given circle
Compasses
Straightedge
Transparencies or posters

Additional Ideas: R.C. Jurgensen, A.J. Donnelly and M.P. Dolciani, Modern Geometry.

Notes to Teachers: For this demonstration, prepare a transparency or poster for each of the following diagrams.

Using the models, show the class that as the number of sides of the inscribed regular polygon is increased, the area of the polygon more closely approximates that of the circle. Similar diagrams for the pentagon and hexagon could also be prepared.

Diagram 1

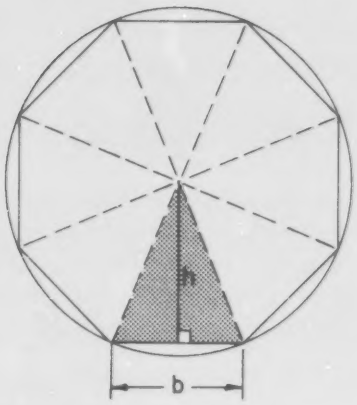


Consider a square inscribed in the circle. Draw the diagonals of the square. The area of the square is the sum of the areas of the four equally sized triangles. Let the length of a side of the square be "b" and the height of the shaded triangle be "h".

Then, area of the square
$= 4 \times$ A of the shaded triangle
$= 4 \times \frac{1}{2}bh$
$= 4b \times \frac{1}{2}h$
$=$ perimeter of square $\times \frac{1}{2}h$

Activity 8-18

Diagram 2



Next consider an inscribed regular octagon.

Area of octagon
= 8 x A of shaded triangle

$= 8 \times \frac{1}{2}bh$

$= 8b \times \frac{1}{2}h$

= perimeter of octagon $\times \frac{1}{2}h$

If we continue this pattern using polygons with more and more sides, the height of each of the triangles approaches the radius of the circle (r) and the perimeter of the polygon approaches the perimeter (circumference) of the circle.

Then area of the circle = perimeter of circle $\cdot \frac{1}{2}h$

or circumference of circle $\cdot \frac{1}{2}r$

$= 2\pi r \cdot \frac{1}{2}r$

$= \pi r^2$

Activity 8-19

Title:	How Many Cubes?
Objective:	This contest allows students to compare estimates of volumes to actual volume measurements.
Number of Students:	Suitable for the entire class working as individuals
Materials:	Cardboard box (i.e., a large shoe box) Centimetre cubes Container to hold guesses
Sources:	Lucille Bisignano, River Heights Junior High School, Winnipeg School Division No. 1; and Karen Guenther, Morden Collegiate, Western School Division No. 47.
Notes to Teachers:	Place the cardboard box in the classroom with the centimetre blocks beside it (to show their relative sizes). Have students estimate the number of cubes required to fill the box and put their estimates on a piece of paper. Have someone collect the pieces of paper and put them in the container. Then have students determine the volume of the box by measuring the sides and then substituting the values into the formula. Identify the student who had the closest estimate and announce the winner to the class.

Grade 8
Enrichment
Geometry

Activity 8-20

Title: Metric Measurement Collage

Objective: This project is designed to increase awareness of metric measurements in everyday life.

Number of Students: Suitable for the entire class working as individuals or in groups

Materials:
Poster paper
Magazines
Newspapers
Glue

Additional Ideas: W.B. MacLean, et al., Mathaction 7.

Description: From magazines and newspapers, collect pictures or diagrams which illustrate the use of metric measurements in our daily lives. Mount these examples on a piece of poster paper to make a collage.

Activity 8-21

Title: Tessellations - I

Objective: This study of patterns provides practice in identifying geometric figures.

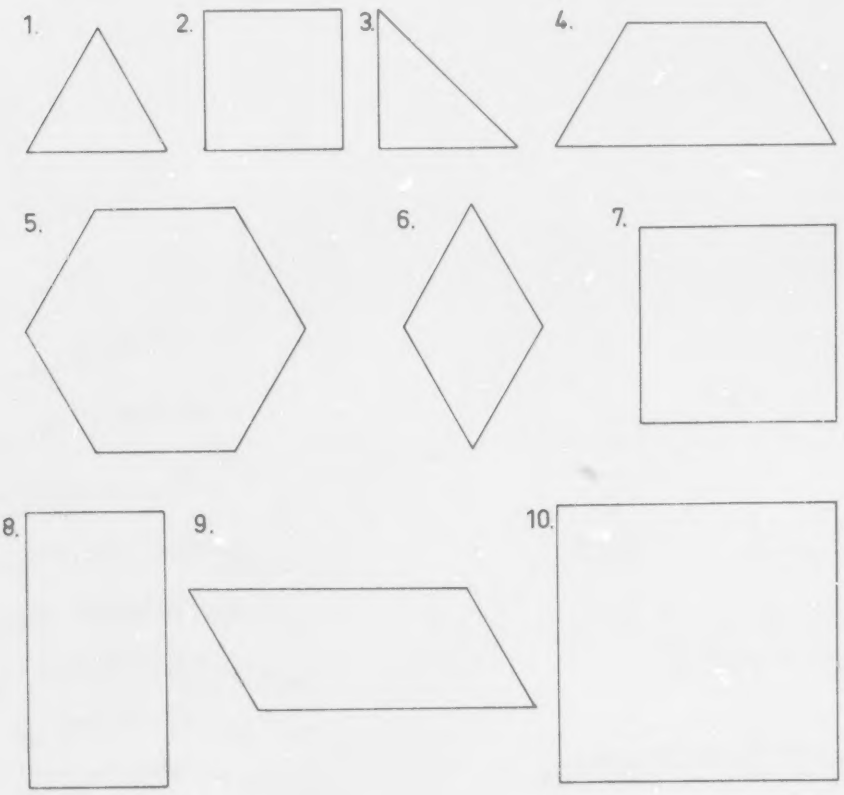
Number of Students: Suitable for the entire class working as individuals

Materials: Tessellation kit or tiles made from a firm material in the shape of an equilateral triangle, an isosceles right triangle, a square, a rhombus, a parallelogram, a trapezoid and a regular hexagon in the sizes shown in B. All measurements are in centimetres. It is preferable to have several of each shape.

Description:

A. A tessellation is a pattern which can completely "fill" the plane without overlapping or leaving gaps. The word "tessellation" comes from an ancient Latin word which means "to cover with tiles." Some tessellations which we encounter in our everyday environment are tiled floors and wall papers. Can you suggest other examples?

B. Using only those tiles which have the shape of an equilateral triangle or an isosceles right triangle, cover each of the following shapes and give the name of the polygon you have covered.



Activity 8-21

C. Make a sketch to illustrate your use of equilateral triangles to form a hexagon (B5).

Make another sketch to show how a large equilateral triangle can be made from several small ones.

D. Which of the following shapes from B can produce tessellations: square, parallelogram, rhombus, trapezoid? Sketch the tessellations.

Can you find in each of these tessellations a larger edition of the basic shape? Outline it on your sketch. Which shapes can produce tessellations but cannot be put together to make larger editions of themselves?

Notes to Teachers: In D a trapezoid can be used to make a tessellation without, however, producing a larger edition of itself.

Activity 8-22

Title: Tessellations - II (The Regular Tessellations)

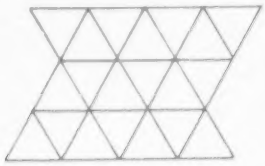
Objective: This exercise shows how a question regarding a geometric pattern can be answered with a numerical argument.

Number of Students: Suitable for the entire class working as individuals

Materials: Tessellation kit or tiles made from a firm material in the shape of an equilateral triangle, a square, a regular pentagon, a regular hexagon and a regular octagon.

Description: A tessellation of congruent regular polygons is called a regular tessellation.

A. Using the equilateral triangles, form a tessellation as shown in the following diagram.



1. What is the measure of each angle of an equilateral triangle?
2. How many triangles fit around each vertex in the tessellation?
3. How many degrees are there in one whole turn about a vertex?
4. What is the relationship among the answers to 1, 2, and 3?

B. Consider a tiling pattern of squares.

1. What is the measure of each angle of a square?
2. How many squares fit around each vertex? Why?

C. Can a tessellation be formed from any of the following:

1. Regular pentagons?
2. Regular hexagons?
3. Regular octagons?

Why?

D. How many regular tessellations are there?

Notes to Teachers: The answer to D is 3.

Activity 8-23

Title: A Model of an Icosahedron

Objective: This procedure can be used to construct a model of a regular polyhedron which may be useful in the discussion of 3-dimensional geometry. An icosahedron has 20 faces, each of which is an equilateral triangle.

Number of Students: Suitable for the entire class working as individuals

Materials: 30 drinking straws for each model
Thread or string

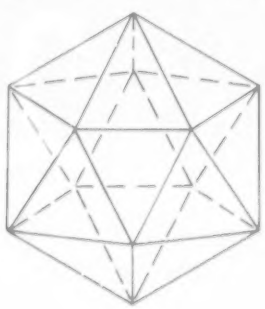
Description: This model will be constructed by threading the drinking straws together to form the edges.

Make sure that you have 30 straws of equal length; for example, 10 cm. Put a thread through 3 straws and tie the ends together to form an equilateral triangle.

Next thread through one of the straws of the triangle and through 2 more straws to form another triangle. Continue this procedure making sure that 5 straws come together at each vertex.

The model will not take its proper shape until most of the straws are in place.

A 2-dimensional diagram of an icosahedron is included below to give an indication of the appearance of the completed model.



To make the model stellated, that is, to give it a starlike appearance, attach 3 straws in the form of a point to each of the 20 triangular faces.

Grade 8
Enrichment
Geometry

Activity 8-24

Title: Tangrams

Objective: This exercise involves making a variety of geometric figures by re-arranging pieces of the puzzle.

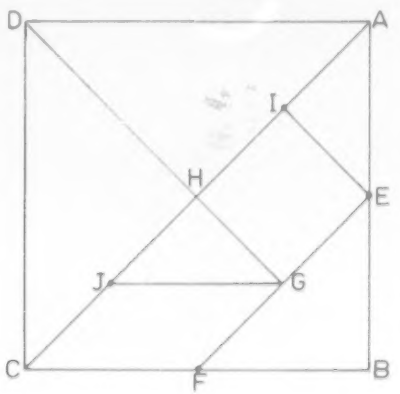
Number of Students: Suitable for the entire class working as individuals

Materials: A set of tangram pieces for each student (available commercially in a game called "Pythagoras," or can be constructed as below)

Additional Ideas: S.A. Krulik, Mathematics Laboratory Handbook for Secondary Schools.

Notes to Teachers: If tangram pieces are not available, a set may be constructed as follows:

1. On cardboard draw a square ABCD with each side at least 10 cm in length.
2. Locate midpoints E and F of sides $\overline{AB}$ and $\overline{BC}$ respectively.
3. Draw $\overline{EF}$ and $\overline{AC}$.
4. Draw the portion of $\overline{DB}$ from D to $\overline{EF}$ (shown in the diagram as $\overline{DG}$). Let H be the point of intersection of $\overline{DG}$ and $\overline{AC}$.
5. Locate I, the midpoint of $\overline{AH}$, and J, the midpoint of $\overline{CH}$. Draw $\overline{EI}$ and $\overline{GJ}$.
6. Cut out the 7 pieces.

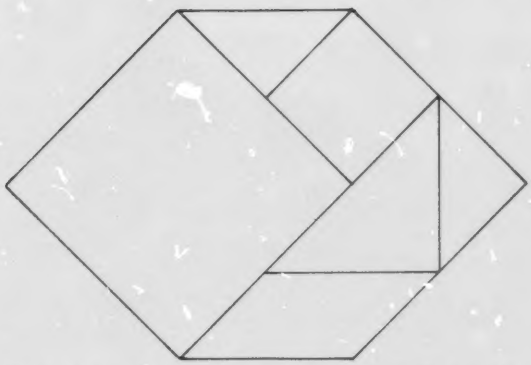


Description: In each of the following exercises, use all 7 tangram pieces. Arrange them in such a way to form:

1. a square
2. a triangle
3. a rectangle which is not a square
4. a parallelogram which is not a rectangle
5. a trapezoid
6. a convex polygon (a polygon in which each of its diagonals fall within its interior; 13 such polygons can be formed with the tangram pieces.)

Activity 8-24

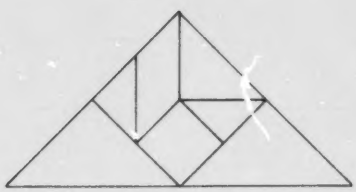
One is:



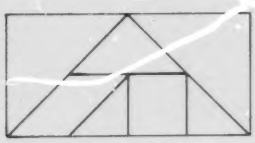
Can you find the other 12? Record your results.

Possible Solutions:

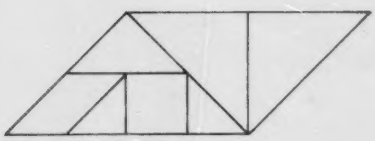
2.



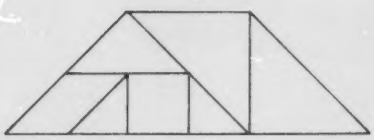
3.



4.



5.



Adaptation:

An interesting exercise for Grade 8 students is to compute the area of each of the tangram pieces using the small square, EGHI, as the unit of area.

For Grade 9 students, making the tangram pieces provides practice in constructing right angles and bisecting segments.

Activity 8-25

Title: Picture Plotting

Objective: This exercise will provide practice in locating points on a Cartesian plane.

Number of Students: Suitable for the entire class working as individuals

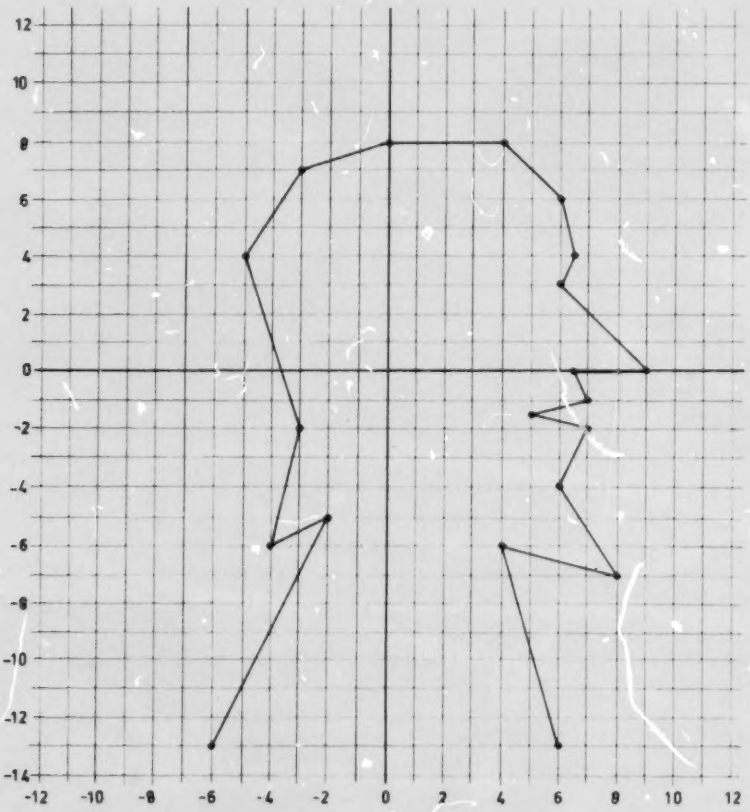
Materials: Graph paper

Additional Ideas: R. Blanchard, Graphiti.

Description: On a piece of graph paper, locate the coordinate axes so that the origin is centred on the page. So as not to detract from the picture, place the unit numerals along the bottom and the left hand side of the page.

Connect the following points in the order in which they are given.

(6, -13), (4, -6), (8, -7), (6, -4), (7, -2), (5, -1.5), (7, -1), (6.5, 0), (9, 0), (6, 3), (6.5, 4), (6, 6), (4, 8), (0, 8), (-3, 7), (-5, 4), (-3, -2), (-4, -6), (-2, -5), (-6, -13).



Activity 8-26

Title: Battleships

Objective: This game provides practice in using coordinates in all four quadrants.

Number of Students: 2 per game

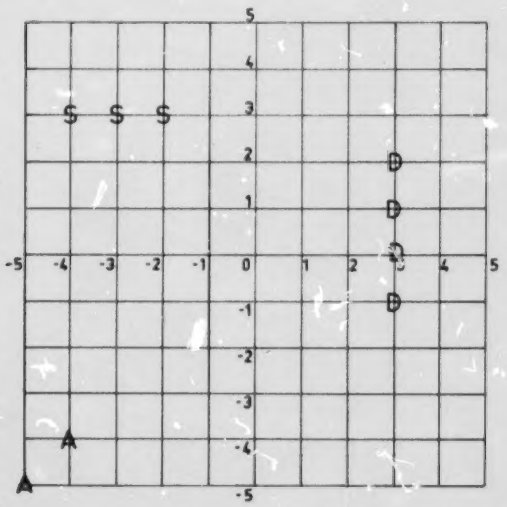
Materials: Copies of a grid and a chart to record coordinates of destroyed ships

Description: Each player is in command of a fleet consisting of 2 aircraft carriers (A), 3 submarines (S) and 4 destroyers (D). The aircraft carriers are restricted to quadrant III, the submarines to quadrant II and the destroyers to quadrants I or IV, as shown on the grid below. The object of the game is to destroy the opponent's fleet by shooting at various locations.

To begin the game each player positions his fleet so that:

1. each ship is at a point having integer coordinates, and
2. the ships of one type are in a straight line (horizontally vertically or diagonally) and occupy consecutive points of the grid on that line.

An example is:



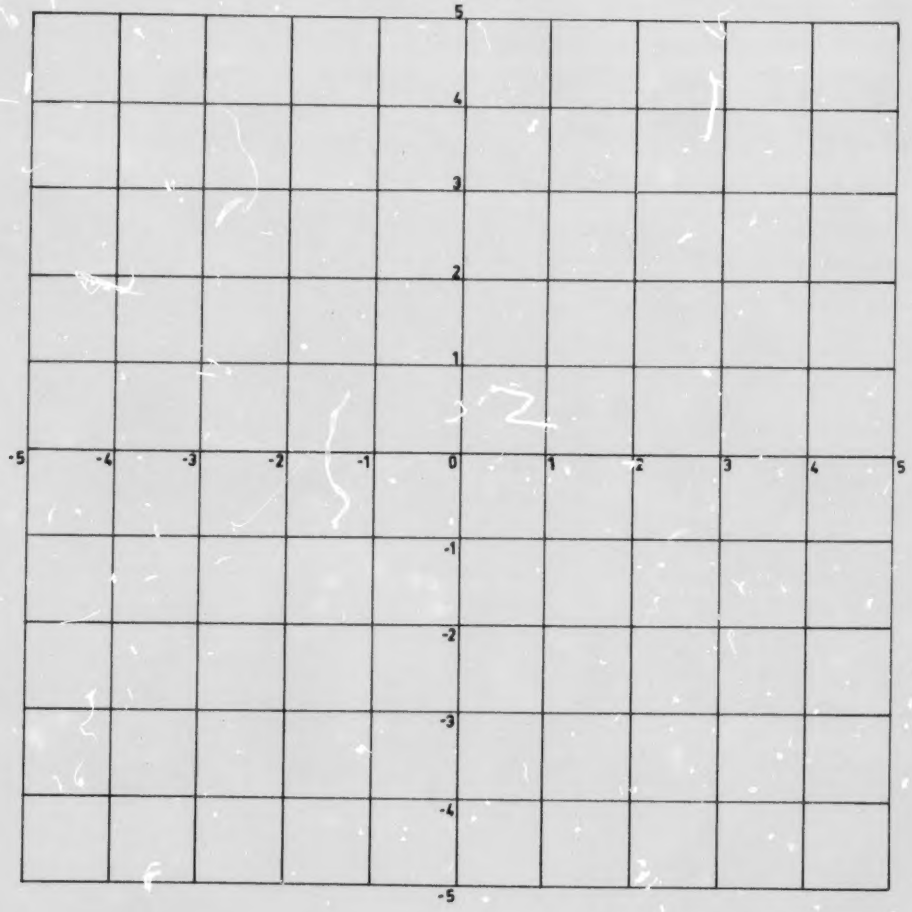
Each player, in turn, takes 3 shots by calling out the coordinates of 3 points. His opponent must tell whether any of his ships were hit, and if so, which one. In the example, if a player shot at the targets (-2, 3), (-1, 2), and (4, 5), his opponent would reply "submarine, miss, miss." The player who is first to destroy his opponent's entire fleet is the winner.

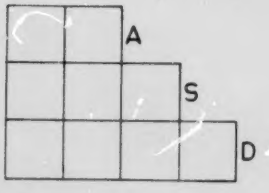
A sample of a game sheet with a grid and an area to record ships which have been hit is included.

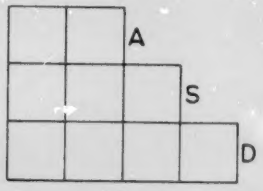
Adaptation: For Grade 7 use only positive coordinates; that is, use only the first quadrant.

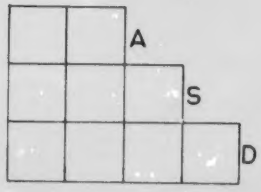
Activity 8-26

BATTLESHIPS









Activity 8-27

Title: Graphing Temperatures

Objective: The preparation of a line graph using temperatures as data is an application of integers in displaying information.

Number of Students: Suitable for the entire class working as individuals

Materials: Temperatures at a specific location from newspapers, Environment Canada or radio weather reports
Graph paper

Description: For one month, keep a daily record of minimum temperatures both for this year and the previous one.

A sample of such data is:

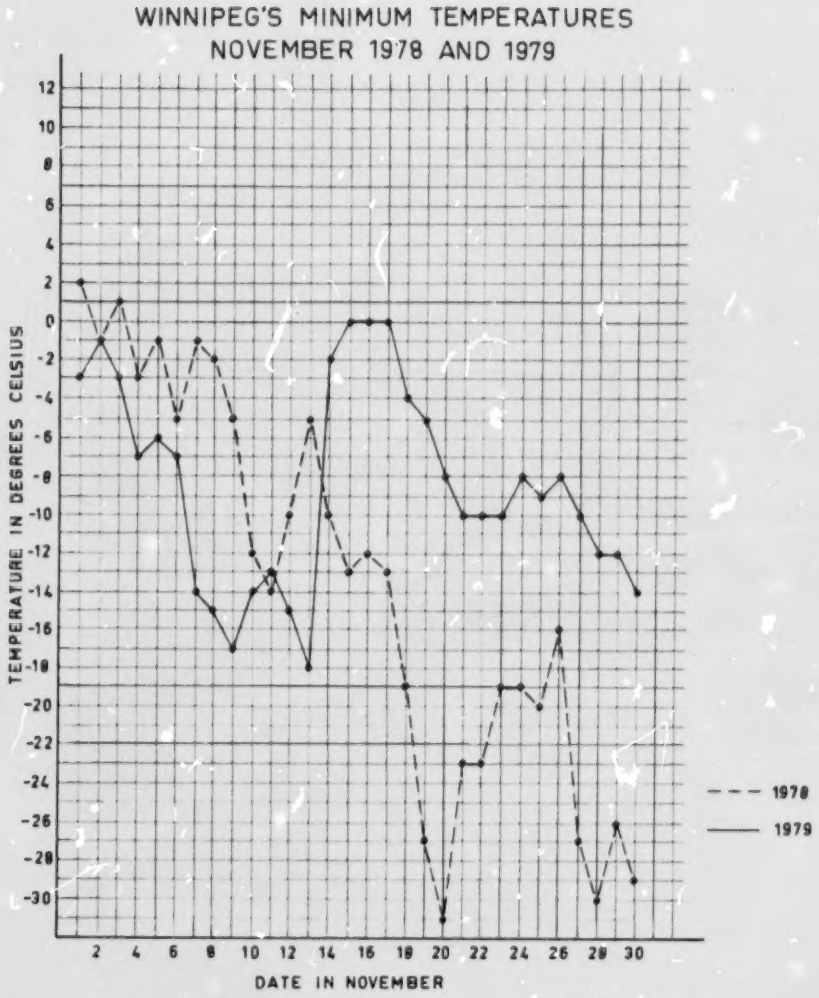
WINNIPEG'S MINIMUM TEMPERATURES DURING
NOVEMBER 1978 AND 1979 IN DEGREES CELSIUS

DATE	1	2	3	4	5	6	7	8	9	10
1978	2	-1	1	-3	-1	-5	-1	-2	-5	-12
1979	-3	-1	-3	-7	-6	-7	-14	-15	-17	-14
DATE	11	12	13	14	15	16	17	18	19	20
1978	-14	-10	-5	-10	-13	-12	-13	-19	-27	-31
1979	-13	-15	-18	-2	0	0	0	-4	-5	-8
DATE	21	22	23	24	25	26	27	28	29	30
1978	-23	-23	-19	-19	-20	-16	-27	-30	-26	-29
1979	-10	-10	-10	-8	-9	-8	-10	-12	-12	-14

Prepare a line graph to illustrate this data using different colours or different connecting patterns (i.e., solid lines, dashes, etc.) for each year. If possible have the information for the previous year entered at the beginning of the month and then enter the data for the current year on a daily basis.

Following is a graph of the preceding data.

Activity 8-27



This activity can be made more involved by including maximum temperatures as well.

VI. Activities for Grade 9

ACTIVITIES FOR GRADE 9

GENERAL

Activity 9-1	Math Puzzle of the Week - III
Activity 9-2	Who Am I?

CORE TOPICS

I. REAL NUMBER SYSTEM

Activity 9-3	Olympic Flame Game
Activity 9-4	The Pythagorean Relation
Activity 9-5	The Diagonal of a Rectangular Solid
Activity 9-6	Stock Market

II. OPEN EXPRESSIONS

Activity 9-7	Exponent Card Game
Activity 9-8	Decode the Message

III. EQUATIONS IN ONE VARIABLE

IV. WORD PROBLEMS

Activity 9-9	Plant Nutrients

V. CONSTRUCTION GEOMETRY

Activity 9-10	Math Art: Triangles and Hexagons
Activity 9-11	Math Art: Squares and Octagons
Activity 9-12	Paper Folding - II
Activity 9-13	Line Designs - II

OPTION TOPICS

I. CONSUMER-RELATED TOPICS

Activity 9-14	Net Pay
Activity 9-15	Budgeting

II. STATISTICS

Activity 9-16	Buying a Bicycle

III. GEOMETRY

Activity 9-17	Pool Table Math
Activity 9-18	Euler's Formula
Activity 9-19	Networks
Activity 9-20	The Möbius Strip
Activity 9-21	Pick's Formula

IV. ALGEBRA

Activity 9-22	Algebr Word Search

V. COORDINATE GRAPHING

Activity 9-23	Transformations

Grade 9
Enrichment

Activity 9-1

Title: Math Puzzle of the Week - III

Objective: The situations presented in these puzzles provide an opportunity for the development of logical reasoning and encourage an interest in mathematics.

Number of Students: Suitable for the entire class working as individuals

Additional Ideas: NCTM Publications (Arithmetic Teacher; The Mathematics Teacher)
Puzzle Books
Math Contests

Notes to Teachers: At the beginning of the week, provide the class with a mathematics puzzle either written on a chalkboard or given as a handout. The problem involved should be one which is not likely to be answered immediately but rather is likely to require some reflection. It need not be directly related to the material currently under discussion in the mathematics course. Read the puzzle to the class and, perhaps, give a hint as to a possible approach. At the end of the week, acknowledge and discuss correct solutions given by members of the class.

Some samples of mathematics puzzles together with possible solutions are included.

A. Three boxes are labelled "Apples," "Oranges," and "Apples and Oranges." Each label is incorrect; that is, each label should be on one of the other two boxes. By selecting only one fruit from one box, with no feeling around or peeking permitted, can you label each box correctly?

B. Arrange the eight digits below so that a number will be formed in which the 1's are separated by one digit, the 2's by two digits, the 3's by three digits and the 4's by four digits.

1 1 2 2 3 3 4 4

C. A digit is represented by the letter A. What is one value of A if the number A1AA2 is divisible by 9? Are there any other values of A that are suitable?

Solutions:

A. Make the selection from the box labelled "Apples and Oranges." Since the label is incorrect, we know it must be either "Apples" or "Oranges." If the fruit selected is an apple, we know the label should be "Apples." Since the label "Oranges" is incorrect, it should be "Apples and Oranges." Also the label "Apples" should be "Oranges."

If the fruit selected is an orange, we know the box labelled "Apples and Oranges" should be "Oranges." Since the label "Apples" is incorrect, it must be "Apples and Oranges." Also the box labelled "Oranges" must be "Apples."

B. 2 3 4 2 1 3 1 4

Activity 9-1

C. If A1AA2 is to be divisible by 9, then A+1+A+A+2 = (3A+3) must be a multiple of 9. Thus A+1 is a multiple of 3. Since A is a single digit, the only possibilities are:

A+1 = 3
A+1 = 6
A+1 = 9

(A+1 = 11 is not possible since A is a single digit.) Therefore A can be 2, 5 or 8.

Activity 9-2

Title: Who Am I?

Objective: This project, involving research into the lives of famous mathematicians, can introduce a personal element into the study of mathematics.

Number of Students: Suitable for the entire class working as individuals

Materials: Mathematics reference books
Encyclopedia

Source: Connie Shaver, Spring Valley Junior High School, St. James-Assiniboia School Division No. 2

Notes to Teachers: As the work of a particular mathematician is encountered in the course of study, have students, either singly or in groups, do some background reading on his life.

One technique for using the research is to have student(s) set up the information in the form of a quiz to be presented to the class, describing first the mathematician's achievements without mentioning his name and then asking the class to identify him. The following is an example of such a description.

WHO AM I?

WHERE WAS I BORN? Greece

WHEN DID I LIVE? 6th century B.C.

WHY AM I FAMOUS? (What did I do?) I was both a mystic and a scientist. I started a secret society on the southeastern coast of what is now Italy. The members of this secret society were vegetarians whose mystical conception of numbers affected every aspect of life. In fact our motto was "All is number." For example, we thought of even numbers as being female and of odd numbers as being male.

I travelled to Egypt and Babylon, and it is generally thought that I learned of the famous theorem bearing my name from the Babylonians. However, my secret society may have been the first to find a proof for this theorem. I am sometimes called the "Father of Matnematics" since I was one of the first to establish mathematics as a rational discipline. In fact I am supposed to have coined the word "mathematics," meaning "that which is learned."

WHO AM I??

Adaptation: This project is appropriate for other grade levels. In Grade 7 the work of Eratosthenes could be discussed in the section on Number Theory. Blaise Pascal, the originator of the calculator, could be referred to in Grade 8.

Actitiy 9-3

Title: Olympic Flame Game

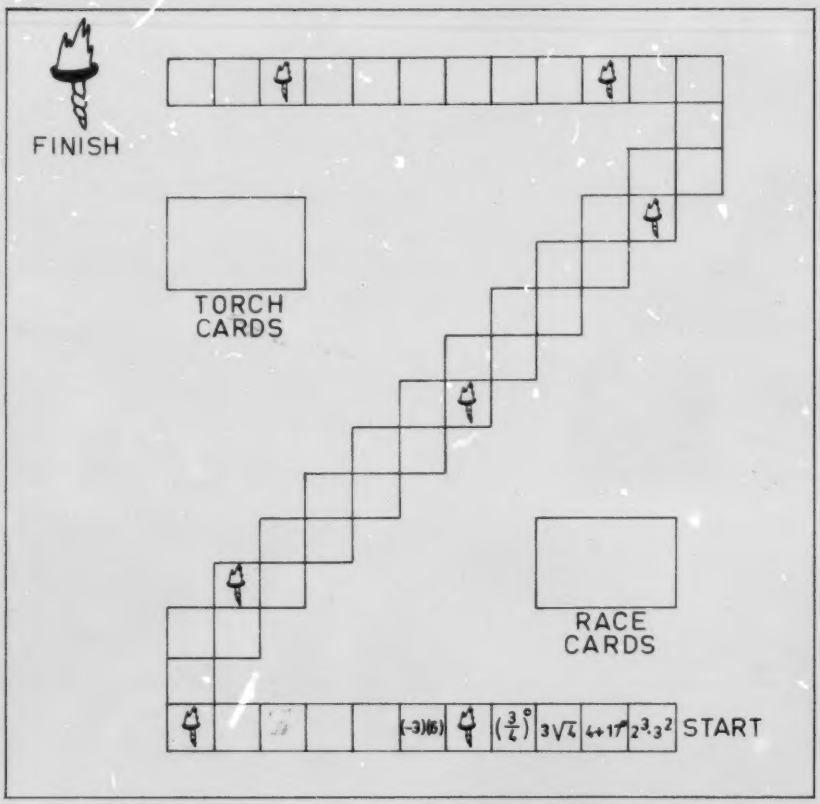
Objective: This game may be used to provide drill in mental computations.

Number of Students: Suitable for 2 to 4 players per gameboard

Materials: Cardboard
2-4 markers per game
1 die per game

Source: Lucille Bisignano, River Heights Junior High School, Winnipeg School Division No. 1

Notes to Teachers: On a piece of cardboard, make a gameboard like the one illustrated below:



In the spaces of the board, put either torches or expressions to be simplified.

Using rectangular pieces of cardboard, prepare 24 TORCH CARDS with more difficult questions.

Activity 9-3

Prepare 12 RACE CARDS with special instructions such as "Advance 3 Spaces," "Go Back 2 Spaces," "Miss a Turn," etc.

Description:

Each player rolls the die in turn and moves his marker the number of spaces indicated on the die. If the player correctly simplifies the expression in the space on which he has landed, he picks a "RACE CARD" and follows the directions. If his simplification is incorrect, he returns his marker to its previous position.

If the player lands on a TORCH space, he must correctly answer the question on the Torch CARD or else miss his next turn.

The first player to reach the Olympic Flame is the winner.

Adaptation:

This game can be used for various topics and for students at various levels by varying the expressions to be simplified.

Activity 9-4

Title: The Pythagorean Relation

Objective: This exercise, with its illustration, is designed to demonstrate the validity of the Pythagorean Relation for right triangles.

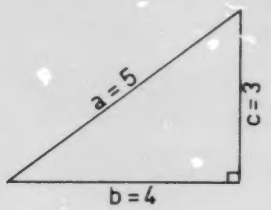
Number of Students: Suitable for the entire class working as a group

Materials:
Transparencies
Graph paper
Ruler
Scissors

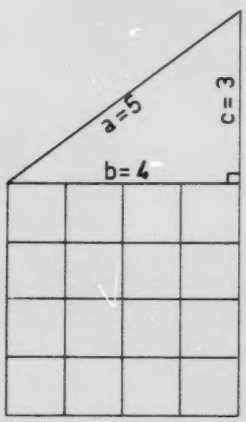
Notes to Teachers: Have the students draw on graph paper a right triangle with legs of 3 and 4 units. Have them confirm that the hypotenuse is 5 units.

Using transparencies, illustrate the Pythagorean Relation for a 3-4-5 right triangle:

1. Initial transparency:

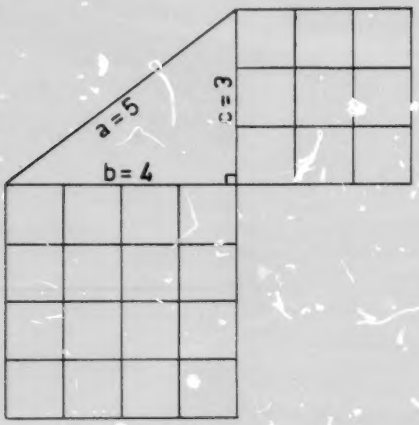


2. With first overlay:

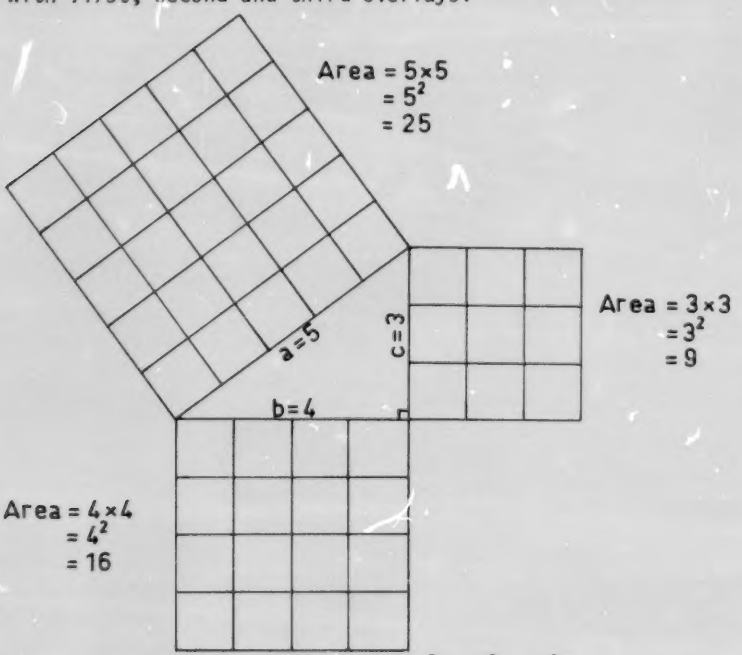


Activity 9-4

3. With first and second overlays:



4. With first, second and third overlays:

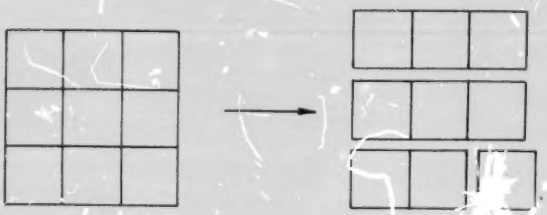


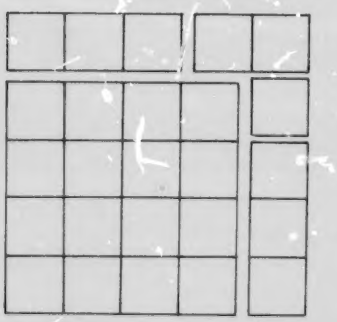
In this illustration, $25 = 16 + 9$ or $5^2 = 4^2 + 3^2$ and hence, $a^2 = b^2 + c^2$.

Activity 9-4

Alternate Activity: Have students cut from graph paper squares of 3 units to a side, 4 units to a side and 5 units to a side. These squares can be arranged about the 3-4-5 triangle drawn earlier. This will create a diagram as in A. Have the students verify the Pythagorean Relation by fitting the two smaller squares over the larger one by cutting where necessary.

For example, the smallest square may be cut and placed around the square of side 4 units to form a square of side 5 units as is shown in the following diagrams.





Activity 9-5

Title: The Diagonal of a Rectangular Solid

Objective: This exercise provides an application of the Pythagorean Relation.

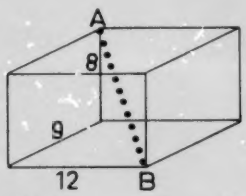
Number of Students: Suitable for the entire class as a group

Materials: Model of a rectangular solid
Transparencies

Additional Ideas: NCTM, Instructional Aids in Mathematics, 34th Yearbook.

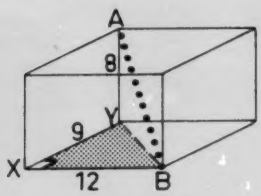
Notes to Teachers: Using a model, identify a diagonal of a rectangular solid. A cardboard box with most of the sides and top cut out will suffice.

With a transparency, indicate the required length AB for a particular rectangular solid with sides of length 8, 9 and 12 units.



Then, with an overlay show right ΔXYB, and using the Pythagorean Relation, calculate:

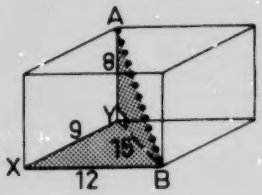
$$YB = \sqrt{9^2+12^2}$$
$$= 15$$



Activity 9-5

With a second overlay, identify right ΔAYB and calculate:

$$AB = \sqrt{8^2+15^2}$$
$$= 17$$



Grade 9
Skill Development
Real Number System

Activity 9-6

Title: Stock Market

Objective: This project, while providing practice in basic computations, also introduces students to one facet of our economic system.

Number of Students: Suitable for the entire class working as individuals

Materials: Copies of a daily newspaper (for 3 weeks)

Source: Connie Shaver, Spring Valley Junior High School, St. James-Assiniboia School Division No. 2

Description: You have been given $2000.00 to invest for 3 weeks. After 2 days of observing the markets and collecting information, "purchase" stocks in not more than 4 companies.

While the money is invested, record the daily high and low price for each of the stocks on the Daily Summary Sheet. On the date on which you decide to sell, compute your returns at the high price.

Determine what fees an investment broker would charge for buying and selling the shares. You may need to ask your teacher for this information.

Finally, calculate the percentage profit or loss which you achieve on your investment.

You may find the following forms useful for recording the information.

DAILY SUMMARY SHEET

DATE	STOCK 1		2		3		4	
	High	Low	High	Low	High	Low	High	Low

Grade 9
Skill Development
Real Number System

Activity 9-6

STOCK MARKET PROJECT

NAME OF STOCKS	1._____	2._____	3._____	4._____
PURCHASE PRICE PER STOCK				
NUMBER OF STOCKS				
COST OF PURCHASE				
REASON FOR PURCHASE				
DATE OF SALE				
SELLING PRICE PER STOCK				
PROCEEDS FROM SALE				
BROKERAGE FEE				
NET PROCEEDS FROM SALE				

SUMMARY: TOTAL PROCEEDS AT END OF PROJECT _____

PERCENT PROFIT (OR LOSS) _____

Activity 9-7

Title: Exponent Card Game

Objective: This game provides practice in the order of operations using exponents.

Number of Students: 2 players per game

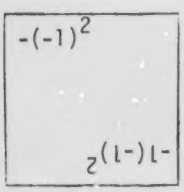
Materials: 28 blank playing cards per game

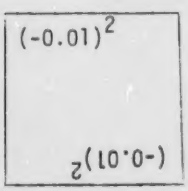
Source: Marlene Treichel, Elmwood Junior High School, Winnipeg School Division No. 1

Notes to Teachers: Below are some expressions involving exponents that can be put on the cards to make a sample deck of 28 cards.

$-(-1)^2$	$(-0.01)^2$	$(-10)^2$	$(-1)^6$	$(1)^3$
100	-3^3	$(1)^{25}$	$\frac{10^5}{10^3}$	$(-3)^3$
-1^5	$\frac{5^7}{5^5}$	4^2	25	$(-5)^2$
$\frac{2^5}{2^2}$	2^3	$(0.01)^2$	Wild	Wild
$(-1)^3$	16	$-\frac{81}{3}$	0.0001	$(-4)^2$
8				

Examples:





Description: Notice that although the expression on each of the cards is different, some may be equivalent because they produce the same number when evaluated.

To begin the game deal 5 cards to each player. Use the same rules as for RUMMY with a "trick" consisting of 3 or more cards with equivalent expressions.

Adaptation: This game can be adapted to other number sets and operations. It can be suitably adapted to any grade level.

Activity 9-8

Title: Decode the Message

Objective: This exercise will give students practice in simplifying open expressions involving addition and subtraction.

Number of Students: Suitable for the entire class working as individuals

Description: Simplify each of the following polynomials. Match your answer with the letters of the alphabet shown below to decode the message. Write the letter of your answers in the same order as the questions are given.

1. 2ab - 7ab + 4ab - 4ab
2. 5a - 2x + 3a + 12x - 8a
3. -ab - 2ab - 3ab
4. 32a - 28a
5. -11ab + 17ab
6. 5x + 3x
7. -2x - 6x
8. -8x + 14x
9. 4ab - 13ab
10. x - 2x - 3x - 4x
11. 6a - 10a
12. -3x + 11x
13. -7ab + 16ab
14. 12x - 3x + 7x - 10x
15. 3a - 2a - a - 4a
16. a + a + a + a
17. 6ab - 19ab + 4ab
18. 5y + 2x + 6x - 5y
19. 9a - 6a + a - 2a + 2a
20. -21a + 17a
21. 14ab - 2ab - 6ab
22. -19ab + 13ab
23. 25ab - 3ab - 13ab
24. -16x + 22x
25. 3a + 3ab - 12a - 12ab + 9a
26. -2ab + 13ab - 5ab
27. -4x + 12x
28. -13a - 2a + 26a - 7a
29. 17x - 12x - 13x
30. 7b - 4a - 4b - 3b
31. a - 2a + 3a - 4a + 5a - 6a + 7a
32. 8a - 6x - 8a - 2x
33. 5x - 12x + 13x
34. 6x - 3x + 12x -7x
35. 21ab - 16ab
36. -14ab + 9ab
37. -3x - 2x + 15x
38. 2a + 2ab - 5a - 8ab + 3a
39. 4a + 4x - 4b + 4x - 4a + 4b
40. -2a + 4a - 6a + 8a
41. 0 - 4a

CODE:

A. 8x	F. -3ab	K. 4ab	P. -2a	U. -6ab
B. -6x	G. 2a	L. 0	Q. -5x	V. -3a
C. 9ab	H. 6x	M. 6ab	R. 4a	W. 12x
D. 5x	I. -10x	N. 5ab	S. -9ab	X. -4ab
E. -4a	J. 3a	O. 10x	T. -8x	Y. -5ab
				Z. -12x

Activity 9-8

Solution: YOUR MATHS TEACHERS ARE MUCH SMARTER THAN YOU ARE.

Adaptation: This idea for practice with operations may be used in many areas. Examples are:

whole numbers	Grade 7
percent	Grade 7
integers	Grade 8

Activity 9-9

Title: Plant Nutrients

Objective: This exercise provides practice in translating word phrases into mathematical symbols and in solving practical problems.

Number of Students: Suitable for the entire class working as individuals

Description:

A. Three numbers are used to indicate the percentages of nitrogen, phosphorus and potassium in a chemical fertilizer. For example, if the analysis is 11-55-0, then 11% of the fertilizer is nitrogen, 55% is phosphorus, and 0% is potassium. Hence, in 1 tonne of 11-55-0 fertilizer there are 110 kg nitrogen, 550 kg phosphorus and 0 kg potassium.

   How much nitrogen, phosphorus and potassium are there in 2 tonnes of fertilizer with an analysis of 23-24-0?

B. To obtain 100 kg of nitrogen, how many kg of 16-56-0 fertilizer would be required? Translate this word problem into an algebraic equation and solve.

C. A farmer requires 100 kg of phosphorus for her garden. If she can buy 0-45-0 fertilizer for $270 a tonne, how much will she need to spend?

D. Compare the costs of the various kinds of fertilizer (information may be obtained from Agricultural Representatives of the Department of Agriculture and from fertilizer dealers).

   By determining the amounts of each type of fertilizer necessary to supply 100 kg of nitrogen, decide which is the cheapest to use for that purpose.

   Make a chart similar to the following. Use it for organizing the data you collect.

Dealer's Name	Name of Fertilizer	Cost	Chemical Analysis	Percent of Nitrogen	Cost for 100 kg

Activity 9-10

Title: Math Art: Triangles and Hexagons

Objective: The constructions of inscribed equilateral triangles and regular hexagons can be used to produce attractive geometric designs.

Number of Students: Suitable for the entire class working as individuals

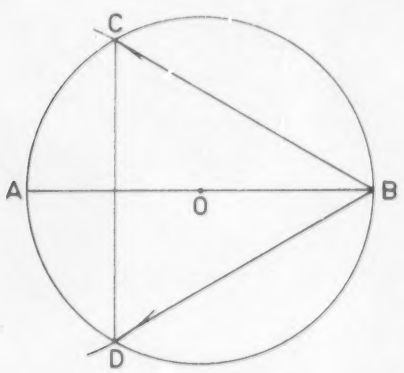
Materials:
White or coloured paper
Felt pens or coloured pencils or pens
Compass
Straightedge

Additional Ideas: D. Seymour and R. Schadler, Creative Construction.

Description: Following are instructions for inscribing an equilateral triangle and a regular hexagon in a circle. By joining various points and colouring or shading parts of the figures, you can create many attractive geometric designs. A few examples of such designs are included.

A. Inscribing an equilateral triangle

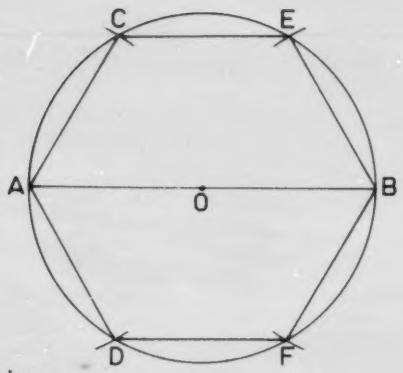
1. With a compass draw a circle with centre O.
2. In this circle draw a diameter AB.
3. With centre A and radius AO, draw an arc intersecting the circle at C and D.
4. Connect B, C, and D to form an equilateral triangle.



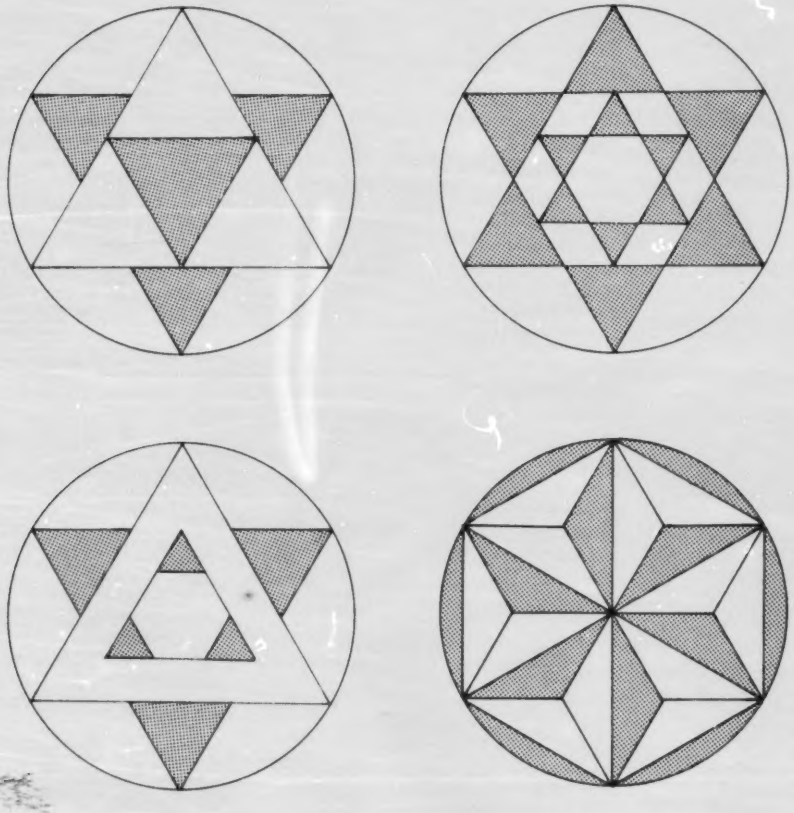
B. Inscribing a regular hexagon

1. With a compass draw a circle with centre O.
2. In this circle draw a diameter $\overline{AB}$.
3. With centre A and radius AO, draw arcs intersecting the circle at C and D. Similarly, with centre at B and radius BO, draw arcs intersecting the circle at E and F.
4. Connect the six points on the circle to form a regular hexagon.

Activity 9-10



C. Examples of designs



Activity 9-11

Title: Math Art: Squares and Octagons

Objective: The constructions of inscribed squares and octagons can be used to produce attractive geometric designs.

Number of Students: Suitable for the entire class working as individuals

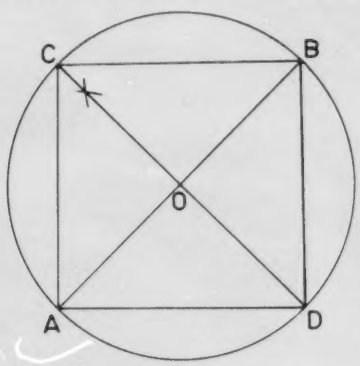
Materials:
White or coloured paper
Felt pens or coloured pencils or pens
Compass
Straightedge

Additional Ideas: D. Seymour and R. Schadler, Creative Constructions.

Description: Following are instructions for inscribing a square and a regular octagon in a circle. Joining various points and colouring or shading parts of the figures produces many attractive geometric designs. A few examples of such designs are included.

A. Inscribing a square

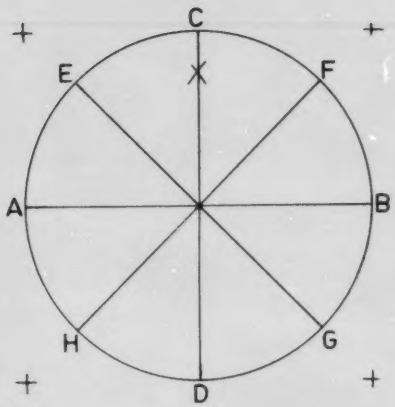
1. Draw a circle with centre O and draw a diameter $\overline{AB}$.
2. Construct another diameter $\overline{CD}$ which is the perpendicular bisector of $\overline{AB}$.
3. Connect the four points on the circle to form a square.



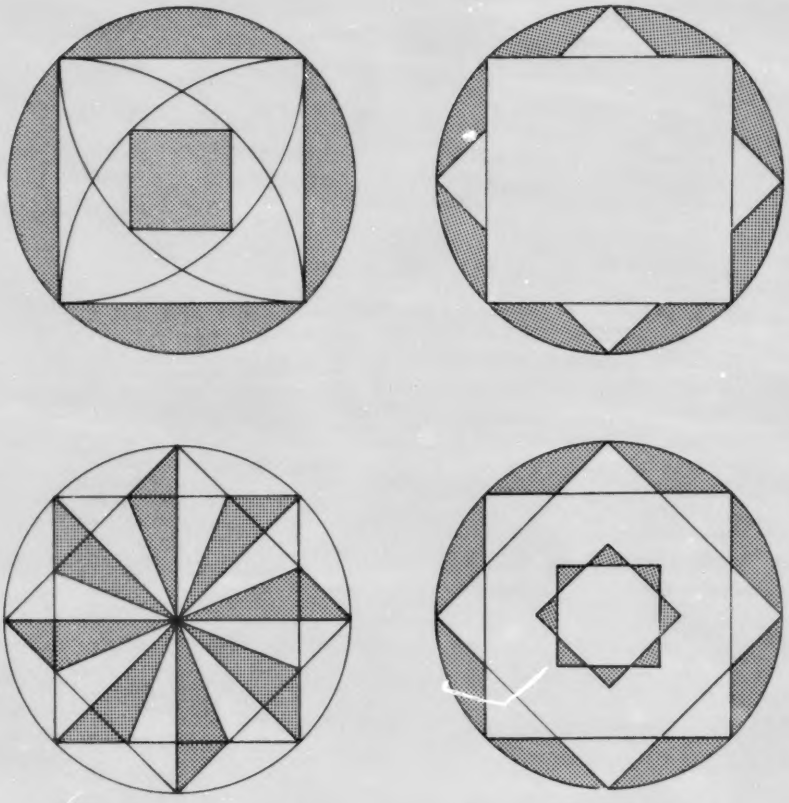
B. Inscribing a regular octagon

1. Draw a circle with centre O and locate points A, B, C and D as in the construction of a square above.
2. Bisect $\angle AOC$, $\angle COB$, $\angle BOD$ and $\angle DOA$ to obtain points E, F, G and H on the circle respectively.
3. Connect A, E, C, F, B, G, D and H, in order, to form a regular octagon.

Activity 9-11



C. Examples of designs



Activity 9-12

Title: Paper Folding - II

Objective: Properties of triangles may be identified by using paper folding as a method of creating basic constructions.

Number of Students: Suitable for the entire class working as individuals

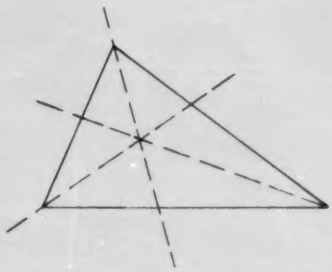
Materials: Scissors
Paper

Additional Ideas: M.A. Sobel and E.M. Maletsky, Teaching Mathematics: A Sourcebook of Aids, Activities, and Strategies.

Description: For the following exercises, cut out 4 triangular pieces of paper.

A. Angle bisectors

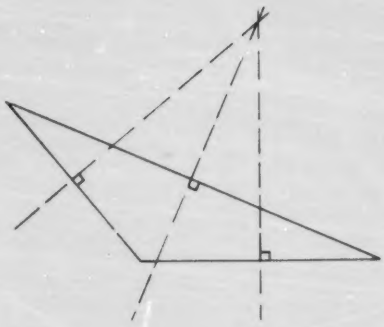
Using one of the triangular pieces, fold one side of the triangle onto another side along a line through the vertex of the triangle. Make a crease. The crease determines the bisector of the angle of the triangle at that vertex. Repeat the process for the two other angles.



Do all 3 angle bisectors pass through a common point?

B. Perpendicular bisectors

Using another triangle, fold it so that one vertex falls onto another vertex. Make a crease. The line formed by the crease is the perpendicular bisector of the side joining these two vertices. Repeat the procedure for the other two sides.

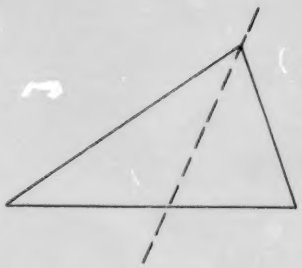


Do all 3 perpendicular bisectors pass through a common point?

Activity 9-12

C. Medians

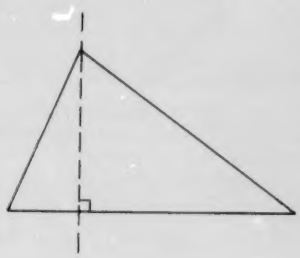
With a third triangle, locate the midpoint of one side (use the process described in Part B). Then fold the triangle so that a crease is formed from the midpoint of the side to the opposite vertex. The line formed by the crease is the median to that side of the triangle. Repeat the process for the other two sides.



Do all 3 medians pass through a common point?

D. Altitudes

On another triangle, fold a side upon itself so that the crease of the fold passes through the opposite vertex. The line formed is called the altitude to that side of the triangle. Repeat the process for the other two sides.



Do all 3 altitudes pass through a common point?

Note to Teachers: See the 7-9 Mathematics curriculum guide, pages 154 and 155, for further information.

Activity 9-13

Title: Line Designs - II

Objective: The combination of basic geometric constructions and simple line designs can produce attractive geometric patterns.

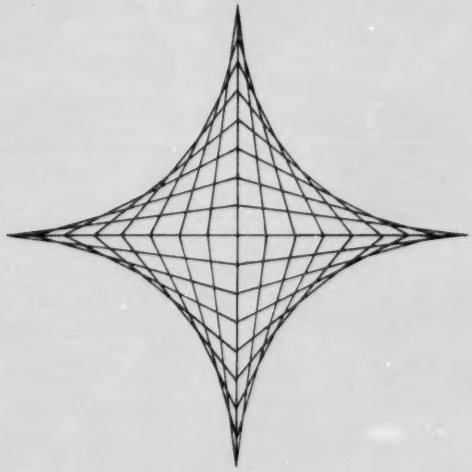
Number of Students: Suitable for the entire class working as individuals

Materials: White or coloured paper
Felt pens or coloured pencils or pens
Straightedge
Compass

Additional Ideas: D. Seymour, L. Silvery and J. Snider, Line Designs.

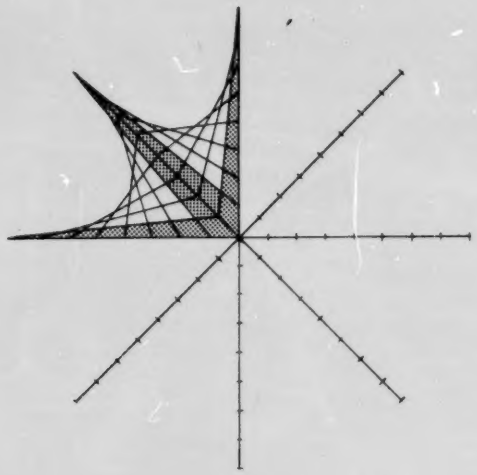
Notes to Teachers: If students are unfamiliar with line designs, have them work through Activity 7-29, "Line Designs - I."

Description: Draw a line segment. Construct a second line segment with the same length as the first in such a way that each segment is a perpendicular bisector of the other. Use the four angles formed to create line designs.



Activity 9-13

More involved designs can be obtained by bisecting angles and using these for even more line designs. The following example makes use of angle bisectors as well as some shading.



Activity 9-14

Title: Net Pay

Objective: This project involves identifying the various deductions made from gross pay.

Number of Students: Suitable for the entire class working as individuals

Materials: Employment application forms

Description: Last year Sue quit school and found a job at $3.37 per hour for a 35-hour work week. She calculated that every two weeks she would receive $235.90. After paying for room and board, she felt that she would have enough money for clothes, transportation, recreation and entertainment, and some left over for holidays and savings.

When Sue received her first pay cheque, she was surprised to see that it was for $182.74 rather than the $235.90 which she expected. The following is a copy of the form which was attached to her cheque.

STATEMENT OF EARNINGS AND DEDUCTIONS										
Basic Pay		Overtime Pay				Additional Pay				Gross Pay
235.90										235.90
Deductions:	(1) 7.08	(2) 1.18	(3) 1.42	(4)	(5)					Non-Stat Deds.
	(6) 0.94	(7)	(8)	(9)	(10)					10.62
Statutory Deductions	Govt. Pension Plan		Unemployment Insurance			Federal Tax				Stat. Deds.
	4.25		2.90			35.39				42.54
Date of Issue	Employee									Net Pay
80 06 30	Sue White									182.74
Pay Period	Employee #			Dept. #		Employer				
06	0010101010					Zapper Company				

Sue had forgotten that certain deductions are made from all wages. Find the amounts deducted for:

Canada Pension Plan _____
Unemployment Insurance Premiums _____
Income Tax _____

In addition, other amounts were deducted from her pay. Can you suggest some reasons these deductions were made?

Activity 9-14

Notes to Teachers:

An interesting exercise that can be used as a follow-up involves working with job application forms.

Obtain an application form for a job that would be available to a person with a Grade 9 education. Have students complete this form and make the following calculations. (Appropriate data on deductions such as income tax, Canada Pension Plan and others would have to be provided.)

1. Determine the gross pay, statutory deductions, non-statutory deductions and net pay that would be received for the job.

2. Determine the percent the net pay is of the gross pay.

Both activities could provide an opportunity for discussing the education levels required for various jobs.

Activity 9-15

Title: Budgeting

Objective: This exercise is designed to show the effect of planning upon expenses and income.

Number of Students: Suitable for the entire class working as individuals

Description:

A. Although most families do not spend more than 25% of their income on food, many teenagers do. You are the only person who can decide whether or not you are paying too much for food or for any other item. But how are you to decide?

To make decisions of this type, it is helpful to do some planning or budgeting. The first step is usually to keep a record of expenses and income over a period of time. The following example is a record of Joe's income and expenses for one month.

INCOME		EXPENSES	
Part-time job ($20 per week)	$ 80.00	Food: Pizzas, snacks, etc.	$ 25.00
Allowance ($6 per week)	24.00	School lunches	15.00
Odd jobs	10.00	Clothes	20.00
		Recreation & Entertainment	30.00
		Transportation	15.00
TOTAL	$114.00	TOTAL	$105.00

By keeping this record, Joe had the satisfaction of knowing that his expenses for the month were $9 less than his income. However, Joe wanted to buy a camera which cost $110. He was not at all pleased to discover that at the rate of $9 per month it would take him over 12 months to save enough money.

Joe asked to have his allowance increased, but his request was denied. He could not spare any more time for other jobs, so he could not increase his income that way.

Faced with this dilemma, Joe decided to reduce his expenses.

Suggest some ways he might do this.

B. Keep a record of your income and expenses for a month and determine which was the greater. After considering this information, state your plans for the next month. Indicate any changes which you might make.

Grade 9
Skill Development
Statistics

Activity 9-16

Title: Buying a Bicycle

Objective: This project provides practice in collecting and organizing data.

Number of Students: Suitable for the entire class working as individuals

Materials: Catalogues
Newspapers

Description: You are planning to buy a new bicycle but as yet have not decided upon a particular one. For assistance in making the decision, complete the following steps.

1. Obtain the prices of 11 different models of bicycles you might consider buying. If accessories are included with a model, find their approximate prices and subtract to obtain a basic price. Add sales tax to each price and round off to the nearest dollar. The following table will help you organize your data.

BICYCLE MODEL OR NAME	PRICE	COST OF ACCESSORIES	PRICE WITHOUT ACCESSORIES	SALES TAX	PRICE WITH TAX	ROUNDED OFF PRICE
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						

2. Arrange the "rounded off" prices in increasing order and find the range (highest price minus lowest price).

3. Determine the mean, median and mode for the rounded off prices.

4. List the advantages and disadvantages of each model.

5. Decide the maximum amount you are willing to spend.

6. By comparing the advantages and disadvantages of those models which are within your price range, choose the bicycle best suited for you.

Grade 9
Enrichment
Geometry

Activity 9-17

Title: Pool Table Math

Objective: These exercises involving data on reflections provide an opportunity to search for relationships.

Number of Students: Suitable for the entire class working as individuals

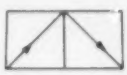
Materials: Graph paper

Additional Ideas: H.R. Jacobs, Mathematics: A Human Endeavor.
S. Krulik, A Mathematics Laboratory Handbook for Secondary Schools.

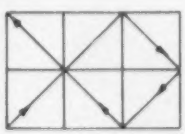
Description: The following exercises involve pool tables of various sizes. Each table has only 4 pockets, one at each corner. The ball is always hit from the lower left hand corner at an angle of 45^0, and the ball continues moving until it reaches a corner. The ball always bounces off the side at an angle of 45^0. There is only one ball on the table.

A. Examples:

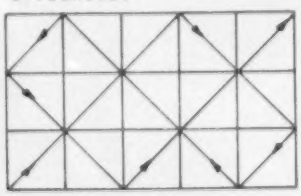
If the table is 2 units long by 1 unit wide, the ball reaches a corner after 1 bounce.



If the table is 3 units long by 2 units wide, the ball reaches a corner after 3 bounces.



If the table is 5 units long by 3 units wide, the ball reaches a corner after 6 bounces.



B. Using graph paper, illustrate the path of the ball for tables of the following dimensions:

1. 5 units long by 2 units wide,
2. 4 units long by 3 units wide,
3. 6 units long by 5 units wide.

Activity 9-17

C. Complete the following table:

UNITS OF LENGTH	UNITS OF WIDTH	NUMBER OF BOUNCES BEFORE REACHING A CORNER
2	1	1
3	2	3
5	3	6
5	2	
4	3	
6	5	

What relationship exists between the number of bounces and the number of units of length and width?

Notes to Teachers: The number of bounces is equal to the sum of the length and width minus 2.

Have students who are interested develop a method for predicting the pocket into which the ball will go.

Activity 9-18

Title: Euler's Formula

Objective: Collecting information that describes polyhedra provides an opportunity to search for patterns.

Number of Students: Suitable for the entire class working as individuals

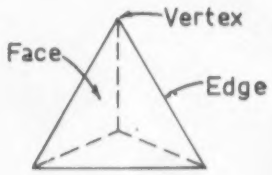
Materials: Models of polyhedra (for examples see Activity 7-28 and Activity 8-23)

Additional Ideas: R. Dubisch, Basic Concepts of Mathematics for Elementary Teachers.

Description: A polyhedron is a three dimensional solid which has flat faces in the shape of polygons. In the following exercises, determine the number of faces (F), edges (E) and vertices (V) of each solid and record the numbers in the table provided at the end.

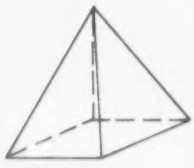
A. Tetrahedron

Examine a model of a tetrahedron and count the number of faces, edges and vertices. Record these numbers in the table.

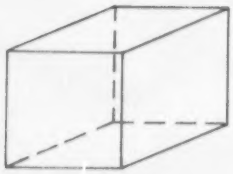


B. For each of the following solids, determine F, E and V and record them in the table.

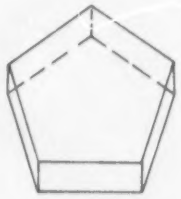
Pyramid with square base



Cube

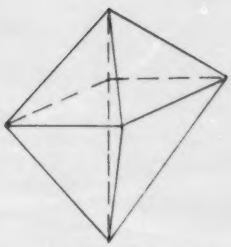


Pentagonal prism



Activity 9-18

Octahedron



C. Draw diagrams of 3 other solids and record F, V, and E for each of them.

D. Can you determine a relationship between F, E, and V?

Table

Polyhedron	Faces (F)	Vertices (V)	Edges (E)
Tetrahedron	4	4	6
Pyramid-square base			
Cube			
Pentagonal prism			
Octahedron			

Notes to Teachers: $F + V = E + 2$.

Grade 9
Enrichment
Geometry

Activity 9-19

Title: Networks

Objective: The exercises presented here provide an opportunity to develop problem-solving skills.

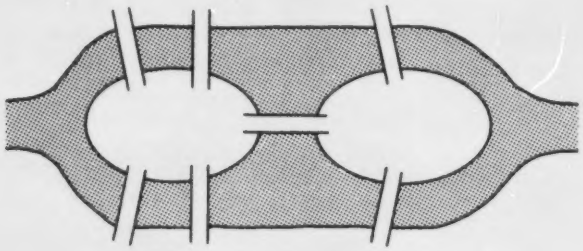
Number of Students: Suitable for the entire class working as individuals

Additional Ideas: M.A. Sobel and E.M. Maletsky, Teaching Mathematics: A Sourcebook of Aids, Activities, and Strategies.

Description:

A. The Seven Bridges of Königsberg

A famous problem originated at Königsberg, a Prussian town on the Preger River, which had seven bridges.



The problem was whether it was possible to take a walk and cross each of the bridges exactly once.

Try to solve the problem by tracing your path with a pencil.

B. Networks

A network is a collection of points and paths connecting them. The points are called vertices; the paths are called arcs.

Some examples of networks are:

1.

2.

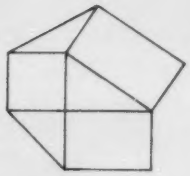
3.

Activity 9-19

4.

5.

6.



Which of these networks can you trace without lifting your pencil or retracing any arc? (Record your answers in the table in C.) Such networks are said to be traceable.

C. A vertex is called odd if it has an odd number of arcs connected to it. It is called even if there are an even number of arcs connected to it.

Complete the following table for the networks given in Part B.

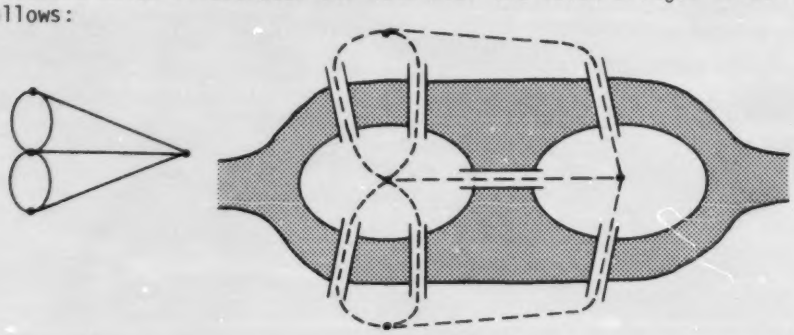
Network	Number of Odd Vertices	Number of Even Vertices	Is the network traceable?
1			
2			
3			
4			
5			
6			

What conclusion can you state about how to determine whether a network can be traced?

Activity 9-19

D. The Seven Bridges of Königsberg

A network which illustrates the walk over the seven bridges is as follows:



Does the consideration of odd and even vertices assist in explaining why the walk over the seven bridges was impossible? Explain.

E. Make some networks of your own. Determine whether they are traceable.

Notes to Teachers: A network is traceable if it has exactly two odd vertices. The number of even vertices is of no consequence.

Grade 9
Enrichment
Geometry

Activity 9-20

Title: The Möbius Strip

Objective: This experiment provides an opportunity for students to discover some unusual properties of surfaces.

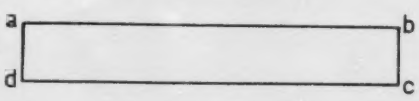
Number of Students: Suitable for the entire class working as individuals

Materials: Paper
Scissors
Tape

Additional Ideas: H.R. Jacobs, Mathematics: A Human Endeavor.

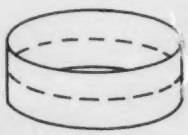
Description: Cut five strips of paper about 30 cm long and 3 cm wide.

A. With a strip of paper form a loop without twisting. (Let a fall on b and d on c.) Tape the ends.



How many edges does the loop have?

Cut the loop midway between the edges. Describe the result.



B. Take another strip of paper, give it a half-twist and tape the ends together. (Let a fall on c and d on b.)

The result is a Möbius Strip.

Activity 9-20

1. Run your finger along one edge. How many edges does it have?
2. Run your finger along one side. How many sides does it have?
3. Cut the loop down the middle. Describe the result.
4. Prepare another Möbius strip, and this time, cut it approximately one third of the distance from the edge. Describe the result.

C. With another strip, form a loop with two half twists. Cut it down the middle and describe the result.

D. Repeat this procedure, but this time, put three half-twists in the loop. Describe the results.

Activity 9-21

Title: Pick's Formula

Objective: This exercise provides practice in recognizing relationships in sequences of numbers.

Number of Students: Suitable for the entire class working as individuals

Materials: Geoboards (or dot paper)
Elastic bands

Additional Ideas: J. Niman and R. Postman, Mathematics on the Geoboard.

Notes to Teachers: If finding the areas of such polygons presents any difficulty, have students work through Activity 7-22, "The Geoboard - II."

Description: This exercise involves calculating the areas of polygons formed by stretching an elastic around nails on a geoboard.

Let b represent the number of nails on the boundary of the figure and n the number of nails in its interior. Let A designate the area of the polygon.

A. On the geoboard form several triangles which have varying numbers of nails on the boundaries but no nails in the interiors. Compute their areas and record the information in the following table.

b	3	4	5	6	7	8	
A							

Some examples are:

b = 3 and A = $\frac{1}{2}$

b = 4 and A = 1

Activity 9-21

If the number of nails on the boundary is increased by 1, what is the effect upon the area?

Can you state a formula which relates A and b where there are no nails in the interior?

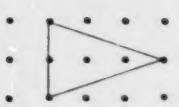
B. On the geoboard, form several triangles each of which has 4 nails on the boundary but varying numbers of nails in the interior. Compute their areas and record the information in the following table.

n	0	1	2	3	4	5	6
A							

Some examples are:

n = 0 and A = 1

n = 1 and A = 2



n = 2 and A = 3

If the number of nails in the interior is increased by 1, what is the effect upon the area?

Can you state a formula which relates A to b and n?

C. Check your formula using various polygons on the geoboard.

Note to Teachers: Pick's Formula is $A = n + \frac{b}{2} - 1$.

Activity 9-22

Title: Algebra Word Search

Objective: This puzzle may help students become more familiar with words frequently encountered in algebra.

Number of Students: Suitable for the entire class working as individuals

Materials: Copies of the array of letters as shown below

Description: Look for the following words in the array. Words may be located hoizontally, vertically or diagonally.

1. variable	11. power	21. integer
2. unlike	12. positive	22. expression
3. trinomial	13. polynomial	23. exponent
4. term	14. parentheses	24. coefficient
5. subtract	15. opposite	25. braces
6. simplify	16. value	26. binomial
7. real number	17. negative	27. base
8. rational	18. monomial	28. add
9. quotient	19. literal	29. algebra
10. product	20. like	30. absolute value

Adaptation: Arrays of letters can be made using words from other topics. Also, students can construct their own word searches.

Activity 9-22

T R I N O M I A L Q B I R G D H S E O
A N K J A S P X V A R I A B L E P G P
U L I T E R A L W C F N N P A K O J P
O M T U O E A V Z B I N L O U D V H O
I P P H N A M T E S A G T L M T I W S
N A O L B L U Y I Q Z S C Y E I F Q I
P R L K T N I Q U O T I E N T U A X T
J E M G R U D K X P N R L O S F X L E
L N L Y E M W S E Y Q A B M V W R N I
Q T V M V B P O W E R M L I W M H P S
N H K Z C E R R U E T B R A C E S A F
I E O U B R X A M V X G V L Y R B D T
T S H A J B Q U R S I M P L I F Y N C
S E N W X C N I W H U L A Z F K O J N
P S A B S O L U T E V A L U E I E I G
B R G Y A E P G Y M T D Z Y S O K H F
F Z O V U F H E S B O D A S Q S K U E
W A R D F F V T Z O L N E Z A U G V D
B M E Q U I N T E G E R O E J B I L E
X L B I T C P Y S C P O L M F T N M O
C J K A P I T K M X J N C Z I R D P C
J Q G D O E E R E I K B V S K A F M G
C E X P O N E N T M D W O L J C L I D
N R C E D T N G H X S P V A L T E E H

Activity 9-23

Title: Transformations

Objective: The following exercises show how coordinates and linear equations can be used to illustrate transformations.

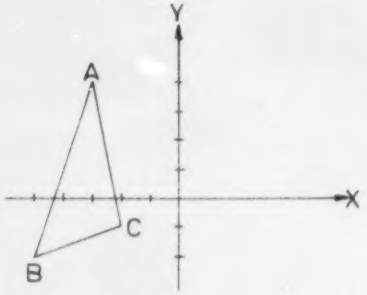
Number of Students: Suitable for the entire class working as individuals

Materials: Graph paper
Straightedge

Description:

A. Slide (Translation)

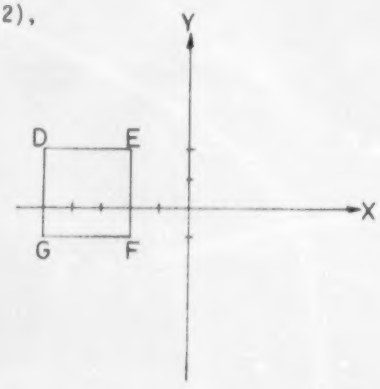
ΔABC has vertices A(-3,4), B(-5,-2) and C(-2,-1).



1. Find the image of ΔABC after a slide of 6 units to the right. Specify the coordinates of the vertices.
2. Find the image of ΔABC after a slide of 4 units to the right and 3 units down. Specify the coordinates.

B. Flip (Reflection)

Consider square DEFG with D(-5,2), E(-2,2), F(-2,-1) and G(-5,-1).

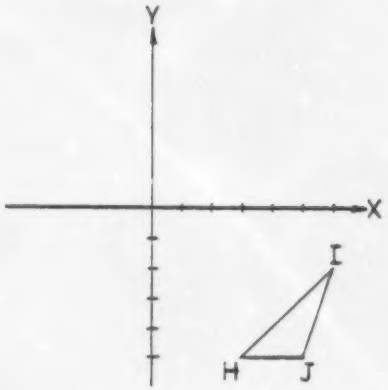


1. Find the image of square DEFG after it has been flipped over the line x=2. Specify the coordinates.
2. Give the coordinates of the image of square DEFG after it is flipped over the line x=y.

Activity 9-23

C. Turn (Rotation)

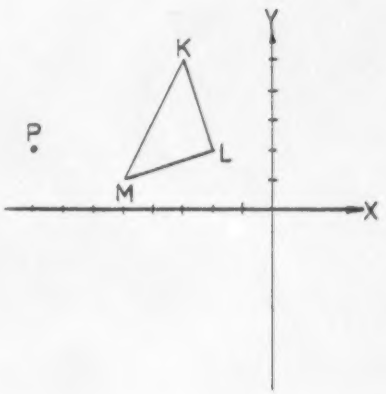
Consider ΔHIJ with H(3,-5), I(6,-2) and J(5,-5).



1. Find the image of ΔHIJ after a half turn about the origin. Specify the coordinates.
2. Find the image of ΔHIJ after a quarter turn about I.

D. Size Transformation

Consider ΔKLM with K(-3,5), L(-2,2) and M(-5,1).



1. Find the image of ΔKLM under a size transformation with centre at the origin and scale factor 2.
2. Find the image of ΔKLM under a size transformation with centre P(-8,2) and scale factor 3.

VII. Bibliography

BIBLIOGRAPHY

Periodicals

Avital, Shmuel, and Stager, Mary, eds. Fun with Mathematics. Toronto: Ontario Institute for Studies in Education. (OISE)[1]

A newsletter containing mathematical problems with varying degrees of difficulty. Published eight months of the school year and sold in sets of ten copies. (7-9)

Games. Box 10147, Des Moines, Iowa, 50349.

An excellent magazine containing puzzles, quizzes and games. Produced six times a year. (K-12)

Manitoba Association of Mathematics Teachers. The Manitoba Mathematics Teacher. Winnipeg: Manitoba Teachers' Society. (MAMT)

Published four times each year. Contains many ideas for classes at all levels. (K-12)

National Council of Teachers of Mathematics. Arithmetic Teacher. Reston, Va.: The Council. (NCTM)

A very useful journal written for elementary mathematics teachers and published eight times per year. Individual or school memberships are available. (K-8)

National Council of Teachers of Mathematics. The Mathematics Student. Reston, Va.: The Council. (NCTM)

A newsletter containing mathematical puzzles and contest problems. Published six times per year, once a month during the months October through March. (7-12)

National Council of Teachers of Mathematics. The Mathematics Teacher. Reston, Va.: The Council. (NCTM)

Written for senior high school and college mathematics teachers. See note above. (7-12)

Books

Adler, Irving. Mathematics: The Story of Numbers, Symbols and Space. Golden Library of Knowledge. New York: Golden Press, 1958. (SCL)*[2]

A book that introduces various areas of mathematics through historical accoun' and physical situations. (4-8)

---

1. Initials in parentheses indicate the publisher or distributor of the material cited. A master list of addresses appears at the end of the bibliography.

2. Items marked by an asterisk may be difficult to order or locate except in libraries.

Bates, W.W., et al. Mathaction. Books 1-8. Vancouver: Copp Clark, 1969. (CCP)

A collection of activities and games which provide another alternative to worksheets as a means of drill. Could be used as a motivational tool. (3-10)

Bell, E.T. Men of Mathematics. Markham, Ont.: Simon & Schuster of Canada, 1960. (MON)

A book that contains detailed accounts of the personal lives and scientific contributions of many well-known mathematicians.

Blanchard, Richard. Graphiti. Hayward, Calif.: Activity Resources Co., Inc. (WEA)

A set of reproducible sheets on coordinate graphing.

Cundy, H.M., and Rollett, A.P. Mathematical Models. 2nd ed. London: Oxford Univ. Press, 1961. (OUP)

Contains detailed instructions for making models to use in illustrating mathematical concepts.

Del Grande, J.J. Geoboards and Motion Geometry for Elementary Teachers. Glenview, Ill.: Scott, Foresman & Co., 1972. (GA)*

A collection of exploratory-type geoboard activities.

Dubisch, R. Basic Concepts of Mathematics for Elementary Teachers. Reading, Mass.: Addison-Wesley Publishing Co., 1977. (A-W)

A discussion of the background needed for teaching elementary and junior high mathematics.

Fair, J., and Rand, K. Handy Math: Focus on Sports. Palo Alto, Calif.: Creative Publications, 1979. (SET)

A sourcebook of activities with limited reproduction permission. Skills in mathematics are practiced within the context of sport. Metric units have been used where feasible. (7-8)

Henderson, G.L. Math Games for Greater Achievement. Skokie, Ill.: National Textbook Co., 1972. (CMC)*

A sourcebook containing 213 motivational games and activities keyed to educational objectives. (4-9)

Hestwood, D., Orf, E., Huseby, E. Crossnumber Puzzles. Palo Alto, Calif.: Creative Publications, 1975. (SET)

Two books - the first dealing with whole number operations (4-7), the second with fractions, decimals and percent operations (5-7) - that provide practice in basic computational skills. Each puzzle is keyed to a specific objective.

Hull, William P. Attribute Games and Problems. Toronto: McGraw-Hill Ryerson, 1978. (MHR)*

Designed to develop thinking skills. Activities with classification, logical relationships between attributes and properties of sets are included. (K-12)

Jacobs, Harold R. Mathematics: A Human Endeavor. San Francisco: W.H. Freeman and Co., 1970. (OUP)

A textbook for those who think they don't like mathematics. Teachers should also purchase the Teacher's Guide which contains both introductory and post-lesson activities. (7-12)

Johnson, D.A., and Glenn, W.H. Probability. Activities in Mathematics, First Course. Glenview, Ill.: Scott, Foresman & Co., 1971. (GA)

The fourth booklet of the series, Activities in Mathematics, First Course, which includes Patterns, Numbers, and Measurement. The booklets contain a series of activities and suggestions for enrichment. (6-7).

Judd, W.P. Patterns to Play on the Hundred Chart. Palo Alto, Calif.: Creative Publications, 1975. (SET)

A series of activities to discover patterns in the hundred chart. (4-9)

Jurgensen, R., Donnelly, A., and Doliciani, M. Modern Geometry. Boston: Houghton Mifflin Co., 1965. (HM)*

A book that introduces the terminology of the New Maths and discusses the meaning of deductive thinking, initial postulates and proofs of theorems. It contains chapters on trigonometry, coordinate geometry, areas and volumes of solids. A few excellent selective overlays are included.

Kennedy, L.M., and Michon, R.L. Games for Individualizing Mathematics Learning. Columbus, Ohio: Charles E. Merrill Publishing Co., 1973. (B & H)*

A book designed for teachers who wish to use games to individualize learning in mathematics. Performance objectives are given for: 1) Meaning of Numbers, 2) Operations on Numbers, 3) Measurement, 4) Geometry, 5) Probability and Statistics, and 6) Logic. (K-7)

Krulik, S. A Mathematics Laboratory Handbook for Secondary Schools. Philadelphia, Pa.: W.B. Saunders Co., 1972. (SN)*

A collection of activities presented in an experiment-type format. General areas include: pre-algebra, algebra, geometry, topology, probability and statistics. (7-12)

MacLean, W.B., et al. Mathaction 7. Vancouver: Copp Clark Publishing Co., 1970. (CCP)

Activity booklet and cards that are part of a program designed to parallel the text, Mathematics-Book Seven. Ideas and activities may

be used independently of the text. Content areas presented are: fractions, decimals, number phrases, vocabulary, geometry, logic and integers.

Marcy, S., and Marcy, J. Addition and Subtraction with a Happy Ending. Palo Alto, Calif.: Creative Publications, 1976. (SET)

An enrichment book that provides practice in the basic skills of addition and subtraction. (4-8)

Marcy, S., and Marcy, J. Mathimagination. Palo Alto, Calif.: Creative Publications, 1973. (SET)

Published as six separate booklets (A-F) or as a complete kit in a loose-leaf binder. Provides practice in basic skills through a variety of interesting puzzles and activities.

Marcy, S., and Marcy, J. Pre-Algebra with Pizzazz. Palo Alto, Calif.: Creative Publications, 1978. (SET)

A series of enrichment books designed to provide practice with skills and concepts taught in pre-algebra courses. (7-9)

Mathematics Resource Project. Ratio, Proportion and Scaling. Prelim. ed. Palo Alto, Calif.: Creative Publications, 1977. (SET)

A collection of reproducible sheets containing a variety of ideas for projects and worksheets. (7-9)

National Council of Teachers of Mathematics. Instructional Aids in Mathematics. Washington, D.C.: The Council, 1973. (NCTM)

A yearbook containing information about the growing number of instructional aids available, suggestions for selecting and evaluating these materials, and guidance in using them. (K-12)

Network: A Mathematics Series. London: Hutchinson for Leapfrogs, 1976. (GLC)

A series of booklets which provide a wide range of ideas and activities in mathematics. (6-10) Three groups of books are available:

1. Action Books - mathematical explorations.
   Titles include: Animations, Bands, Chance, Codes, Cubes, Doodles, Folds, Moves, Orders, Pegboards, Prints, Tiles, and Dots.
2. Link Books - anthologies of pictures and diagrams.
   Titles include: Leads, Leaves, and Links.
3. With Few Words - workbooks which communicate by visual clues.
   Titles include: Blue Book, Green Book, and Orange Book.

Niman, J., and Postman, R. Mathematics on the Geoboard. New Rochelle, N.Y.: Cuisenaire Co. of America, 1974. (SET)

A book of geoboard activities that focuses on patterns. (7-12)

O'Daffer, P.G., and Clemens, S.R. Geometry: An Investigative Approach. Menlo Park, Calif.: Addison-Wesley Publishing Co., 1976. (A-W)

A reference for geometry teachers at all levels that explores the

nature of geometry using the discovery approach. Many ideas are new and not a rehash of previous experiences in high school geometry. Topics include polyhedra, tessellations, motion geometry, topology, similarity, number patterns, and measurement using metric units. (4-10)

Pasternak, M., and Silvey, L. Pattern Block Activities - Book B. Palo Alto, Calif.: Creative Publications, 1975. (SET)

Contains activities for fractions, geometry, area and perimeter. (4-9)

Puzzling Puzzles. Yale Series. Toronto: The Yale Book Co. Ltd. (Yale)

A collection of 25 puzzles with a mathematical basis. Answers are provided. (7-9)

Sawyer, W.W. Mathex. Toronto: Encyclopaedia Britannica, 1970. (EBP)

A large collection of discovery or laboratory-type activities for all grade levels. (K-8)

Schadler, S. Pic-A-Puzzle. Palo Alto, Calif.: Creative Publications, 1970. (SET)

Illustrates the creation of puzzle designs. (1-12)

Seymour, D., et al. Aftermath. Books 1-4. Palo Alto, Calif.: Creative Publications, 1970. (SET)

A series of enrichment activities to reinforce ideas and introduce new ones. Contains cartoons, humour, designs, puzzles, codes, and games. (5-9)

Seymour, D., and Schadler, R. Creative Constructions. Palo Alto, Calif.: Creative Publications, 1974. (SET)

Suggests many designs for drawings that can be made with straightedge and compass. (5-12)

Seymour, D., and Shedd, M. Finite Differences: A Pattern-Discovery Approach to Problem-Solving. Palo Alto, Calif.: Creative Publications, 1973 (SET)

A discussion of a pattern-discovery approach to problem-solving.

Seymour, D., Silvey, L., Snider, J. Line Designs. Palo Alto, Calif.: Creative Publications, 1974. (SET)

Explains the techniques of curve stitching and contains ideas for creating designs. (6-10)

Sobel, Max A., and Maletsky, Evan M. Teaching Mathematics: A Sourcebook of Aids, Activities and Strategies. Englewood Cliffs, N.J.: Prentice-Hall, 1975. (P-H)

A book that contains a number of motivational ideas suitable for many grade levels and abilities, a discussion of various recreational

activities appropriate for the classroom, and a collection of laboratory experiments planned for individual or class use. Included are instructions for many inexpensive aids and models useful in teaching, suggestions for developing audio-visual facilities, and extensive listing of resources and references. (7-12)

Stein, R.D. Mathematics: An Exploratory Approach. New York: McGraw-Hill Book Co., 1975. (MHR)

A book that views mathematics primarily as a kind of activity rather than as a body of knowledge. Many ideas are presented through experiments. (7-12)

Stokes, W.T. Notable Numbers. Palo Alto, Calif.: Stokes Publishing Co. (STK)

A book presenting different types of numbers together with exercises to assist in studying their properties. (7-12)

Wenninger, Magnus J. Polyhedron Models for the Classroom. Washington, D.C.: National Council of Teachers of Mathematics, 1975. (NCTM)

A booklet which describes the history of and includes patterns for creating some pleasing geometrical models. (7-12)

PUBLISHERS AND DISTRIBUTORS

ACTIVITY RESOURCES CO., INC. .....AR
P.O. Box 4875
Hayward, California 94545

ADDISON-WESLEY .....A-W
36 Prince Andrew Place
P.O. Box 580
Don Mills, Ontario M3C 2T8

BELL & HOWELL LTD. .....B & H
230 Barmac Drive
Weston, Ontario M9L 2X5

COLLIER-MACMILLAN LTD. .....CMC
539 Collier Macmillan Drive
P.O. Box 699
Cambridge, Ontario N1R 5W9

COPP CLARK PITMAN .....CCP
517 Wellington Street West
Toronto, Ontario M5V 1G1

ENCYCLOPAEDIA BRITANNICA
PUBLICATIONS LTD. .....EBP
2 Bloor Street West
Suite 1100
Toronto, Ontario M4W 3J1

GAGE PUBLISHING LTD. .....GA
164 Commander Blvd.
P.O. Box 5000
Agincourt, Ontario M1S 3C7

GLC PUBLISHERS LTD. .....GLC
115 Nugget Avenue
Agincourt, Ontario M1S 3B1

HOUGHTON MIFFLIN CANADA LTD. .....HM
150 Steelcase Road West
Markham, Ontario L3R 1B2

MANITOBA ASSOCIATION OF
MATHEMATICS TEACHERS .....MAMT
c/o Manitoba Teachers' Society
191 Harcourt Street
Winnipeg, Manitoba R3J 3H2

NATIONAL COUNCIL OF TEACHERS
OF MATHEMATICS .....NCTM
1906 Association Drive
Reston, Virginia 22091

McGRAW-HILL RYERSON LTD. .....MHR
330 Progress Avenue
Scarborough, Ontario M1P 2Z5

MONARCH PRESS .....MON
3547 Bathurst Street
Toronto, Ontario M6A 2C7

ONTARIO INSTITUTE FOR STUDIES
IN EDUCATION .....OISE
252 Bloor Street West
Toronto, Ontario M5S 1V6

OXFORD UNIVERSITY PRESS .....OUP
70 Wynford Drive
Don Mills, Ontario M3C 1J9

PRENTICE-HALL OF CANADA LTD. .....P-H
1870 Birchmount Road
Scarborough, Ontario M1P 2J7

W.B. SAUNDERS CO. CANADA LTD. .....SN
1 Goldthorne Avenue
Toronto, Ontario M8Z 5T9

SCHOLARS' CHOICE LTD. .....SCL
50 Ballantyne Avenue
Stratford, Ontario N5A 6T9

SETSCO EDUCATIONAL LTD. .....SET
567 Clarke Road
Coquitlam, British Columbia V3J 3X4

STOKES PUBLISHING CO. .....STK
Box 415
Palo Alto, California 94302

WESTERN EDUCATIONAL ACTIVITIES
LTD. .....WEA
Box 3006, Station 'D'
Edmonton, Alberta T5L 4J8

YALE BOOK CO. .....YALE
34 Butternut Street
Toronto, Ontario M4K 1T7